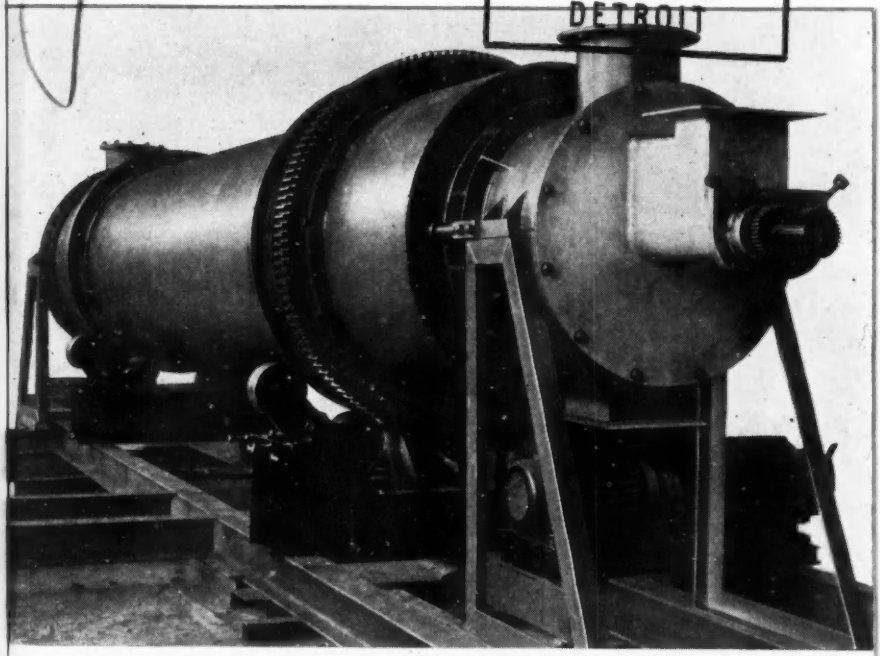
WITH METALLURGICAL SECTION

The Chemical Age

VOL LXV 1 SEPTEMBER 1951 No. 1677



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The
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The Human Side of Industry

IN nearly all aspects of life it is the bad or the unusual which makes news, and the family or business which runs smoothly and contentedly rarely receives the publicity which is received by the one which repeatedly forces itself before the public eye by strife and dissension. So it is with the chemical industry. Little is heard about its industrial relations, for instance, and this is undoubtedly due to the fact that the relationship between employers and employees has always been of the very best. No matter how well matters may be going, however, there is always a chance of improvement and a danger, unless methods are kept under constant review, of complacency displacing efficiency. It is undoubtedly a good thing that attention should now and again be drawn to this aspect of our industry. It was, therefore, particularly satisfying to read (in *Chemistry and Industry*, No. 34, 25 August, 1951) the paper read by Dr. W. H. Garrett, M.B.E., to the Canadian Section of the Society of Chemical Industry in Montreal on 'Industrial Relations in the British Chemical Industry'.

The mechanics and modes of procedure in industrial negotiation were traced by Dr. Garrett from the formation of the Joint Industrial Councils following the recommendations of the Whitley Committee in 1916, and it should be a source of pride for members of the industry to learn that their Joint Council was one of the first to be established. Thanks to the far-sighted leaders of the industry it was realised that adequate organisation on the part of both employers and workpeople was necessary and in 1917 what is now known as the Association of Chemical and Allied Employers was formed. This body (as Dr. Garrett explained to his Canadian audience) now deals with all questions of wages, working conditions, the training of workmen, holidays, overtime, etc.

Besides outlining the organisation of the industry's industrial relations machinery, Dr. Garrett had a number of most interesting suggestions or comments to make. Industry to-day (he said) is experiencing great changes and if the free enterprise system is to survive it must have 'some definite constructive forward policy' to offer to labour in opposition to the doctrines of Communism. Resistance alone will not be sufficient, nor in an age of progress is a fight for the *status quo* likely to succeed. A new concept of the rôle played by labour in industry must be realised, in Dr. Garrett's

view. The chemical industry, which owes its birth and growth to the courage to experiment and try out new methods, should be able to discover and try out a new fundamental labour policy.

Dr. Garrett believes that employees in an industry should be regarded as investors in the industry just as much as are the shareholders. Without the time and skill 'invested' by the workers, the capital of the shareholder and the ideas and techniques of the management are of no avail. The contributions of all three, in fact, are interdependent and each is individually entitled to a reasonable return, proportionate to their contribution. In Dr. Garrett's view it should be possible to evolve a constructive policy of employee relations capable of successfully resisting the socialistic influences prevalent to-day. At heart (he believes) every man is an individualist and a policy which appears to him as such must surely prevail against Communism—which can ultimately only lead to the loss of individuality and turn the free-thinking citizen into something less than a man.

Despite the size of the British chemical industry (the estimated number employed in May of this year in the chemical and allied trades was 487,400) the success of its Joint Industrial Council is evidenced by the fact that there has been no major strike for 24 years, while during that period only three matters have had to be referred to the National Arbitration Tribunal. Few industries in Britain (or in any other country) have such a good record although the flour milling, cotton, wool, steel and cement industries have not had any serious stoppages for many years. Unfortunately, conditions in the docks, road and rail transport and in the coal mines have been far less tranquil and nationalisation has completely failed to bring about any improvement. In fact, it would seem clear that now the intelligent worker in any contented industry (i.e., one where management and labour collaborate for the common good) is likely to oppose strongly any meddling with his affairs and to use his influence to prevent nationalisation, which he realises must inevitably tend to a less human approach to his problems.

Dr. Garrett is undoubtedly one of the most knowledgable and most experienced of the chemical employers' representatives. He has only just retired as chairman of the Executive Board of the A.C.A.E. after three years in office, and he has made a special study of industrial relations for many years. He is a director of Monsanto Chemicals Ltd., and until a recent change of policy on the part of the company, was the director in charge of production. Although his views may seem radical to the more staid and conservative members of the trade, those who know him will realise that he is not a man who speaks without first studying all aspects of the situation most carefully. His opinions, therefore, are not to be dismissed lightly. In our view, he speaks real wisdom, and we would like to see the leaders of the chemical and allied industry diligently studying his remarks. Chemists have long been looked to for a lead in many fields and it would be most appropriate if the chemical industry could set an example with regards to industrial relations.

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Notes & Comments

Overseas Trade

CHEMICAL exports in July, although below the peak figure of £13,354,473 attained in May, recovered to £12,470,338, which showed an increase in value of £932,088 over the previous month, and was over £3 million better than in July, 1950. Notable increases in values of exports of chemicals, drugs, dyes and colours in July, 1951, revealed by the *Trade and Navigation Accounts of the United Kingdom*, compared with the same month of the previous year, include: detergents £132,224 (£67,038); disinfectants, insecticides, etc., £571,995 (£297,065); fertilisers £71,217 (£28,515); sodium compounds £549,054 (£194,088). Drugs, medicines and medicinal preparations with a total value of £2,965,268, showed an improvement of over £1 million compared with July, 1950. While rising prices may have had some small effect on these values, the maintenance of such a high level of exports in spite of the difficulties of raw material shortages and needs of the defence programme, reflects the healthy state of the chemical industry.

Scientist Diplomatists

NOT so many years ago the suggestion that scientists should receive diplomatic status, and that science and technology should be allowed to influence foreign policy and international relations, would have been received at least with surprise, if not with ridicule. The high esteem in which science and its practitioners is now held and the confidence in their ability to help shape current affairs is fully appreciated in the U.S.A., and an earnest of her intentions was the announcement last year (THE CHEMICAL AGE, *62*, 875), of a scheme to establish a world-wide network of American scientific attachés to advise the mission staffs on the science aspects of policy and problems, and to represent the U.S. Government abroad in scientific matters. The names of five chemists recently announced by the U.S. Department of State (see page 307 this issue), to assume their overseas posts—two to London, two to Stockholm, and one to Berne—brings a stage further the project which was first proposed after a review of the Hoover Commission's proposals for reorganising the conduct of U.S. foreign relations. Such a scheme has much to recommend it and the American experts can be assured of a welcome and co-operation in London. It would indeed be pleasant to be able to reciprocate with British representatives appointed to New York and other embassies. Unfortunately, the problem of exporting scientific manpower cannot at present be considered for such purposes. First priority must be given to trying to meet scientific and research shortages at home and the urgent need of greater scientific liaison within the Dominions and Commonwealth.

Atomic Energy Control

DEVELOPMENT of atomic energy in Great Britain is obviously a matter of considerable concern, whether it is regarded from the problem of defence or as a long-term project with its possible application to industrial uses. So little information is released that it is perhaps hard to assess fairly the progress made, but an indication that all is not entirely satisfactory was the defeat of the Government in the House of Lords last July on a motion submitted by Lord Cherwell, which regretted the slow progress made in this country in the development of atomic energy and suggested that work on this subject should be transferred from the Ministry of Supply 'to a special organisation, more flexible than the normal Civil Service system, under the direct control of the head of the Government.' It was then revealed that Lord Portal of Hungerford sought to retire from the post of Controller of Atomic Energy, which he had originally undertaken for three years, but had continued for five. This impending retirement, it was argued by Lord Cherwell, made a change in the organisation all the more vital. Lord Alexander, Chancellor of the Duchy of Lancaster, for the Government contended that the development of atomic energy had never

suffered from lack of money and had always been given the highest priority for materials and labour. While the Government had not 'dosed its mind' on this matter, it did not consider at present that any special organisation would be more effective than the existing one. Lieutenant-General Sir Frederick Morgan, who is regarded with high esteem by all who knew his unobtrusive but valuable service during the war, will take up his position as Controller of Atomic Energy at the beginning of next month. The general takes over at a critical time, and he may well find all his experience of planning and resource taxed to their utmost if the 'obstructions and frustrations' alleged by Lord Cherwell are to be overcome and the future development of atomic energy in this country in a satisfactory manner, is to be assured.

Radioactive Tracers in Wool Research

RADIOACTIVE isotopes are being used by the Wool Industries Research Association at Torridon, Leeds, for investigating the structure of the wool substance keratin; in experiments into the physical chemistry of dyeing processes, and in investigating the consumption of synthetic detergents. The isotopes are prepared in the atomic piles at Harwell, Berkshire, and transported weekly to Torridon in lead caskets.

Radiocopper is being used to assist in the investigation of the constitution of the complicated long chain molecules which comprise the molecule of keratin. The long chains of the keratin molecule are first broken down by hydrolysis, after which the resultant constituents (amino acids) are separated by chromatography. Quantitative measurements are then obtained by combining the amino acids with radiocopper, the activities of the various acid-copper complexes thus formed being determined with a Geiger-Muller counter.

Radiobromine and radiosodium are being used as tracers in experiments to gain some insight into the physical chemistry of the dyeing processes; in this case the tracer enables a determination to be made of the rate at which a dye solution is being absorbed by wool.. Radiosodium is being used in connection with experiments concerned with the consumption of synthetic detergents used in the scouring of wool. Radiosodium was incorporated in the detergent, its radioactivity being used to determine the distribution of the detergent between the wool fibres, grease and scouring liquor.

The Geiger-Muller counter, being used here, measures the radiation coming from radiocopper, which has been combined with the wool substance keratin to act as a tracer

Engineering, Marine & Welding Exhibition

Plant and Equipment to be Seen at Olympia

A WIDE range of engineering and industrial equipment, scientific instruments and automatic controls, pumps, valves, welding and foundry apparatus of interest to the chemist and the chemical engineer is to be seen at the Engineering, Marine and Welding Exhibition (incorporating also this year the Foundry Trades Exhibition) which opened at Olympia, London, yesterday (30 August), and continues until 13 September.

First held in 1906, the exhibition has taken place ever since in alternate years with the exception of the interruptions caused by the two world wars, and is one of the largest events of its kind in the world. This year's honorary president is Engineer Vice-Admiral Sir Harold Brown, G.B.E., K.C.B., who is president of the British Internal Combustion Engine Manufacturers' Association, and chairman of the Machine Tool Advisory Council of the Ministry of Supply.

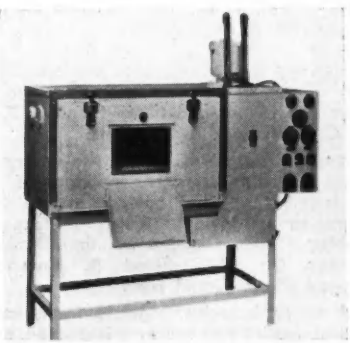
Boiler development from the first water-tube boiler designed by Stephen Wilcox in 1856 to the boiler plant of a modern power station are illustrated on the stand of BABCOCK & WILCOX, LTD., together with a collection of models, colour transparencies and photographic enlargements illustrating modern boiler firing techniques.—**Stand 3, Row K, Ground Floor, Grand Hall.**

Latest addition to its wide range of apparatus for industrial processes is a humidity test cabinet shown by BARLOW-WHITNEY, LTD. It is a compact self-contained unit and has been specially developed for all present day dry and damp heat tests with the exception of the tropical storage tests. Temperature range adjustment is from 20°C. to 110°C., normal control being within ± 0.5°C. Resultant humidity adjustment is from 40 to 100 per cent according to the dry heat temperature. The metal cased heaters and humidifying unit are controlled by sensitive 'dry' and 'wet' bulb adjustable contact thermometers which are used in conjunction with special relays permitting of very close control.

Other interesting exhibits by this company include a medium size industrial oven with forced air circulation and ventilation system by means of a powerful pressure fan built into the roof. Air can be totally or partially re-circulated by a single lever damper control which can be set so that fresh air only passes through the oven. This is of particular value during initial drying out operations. Also on view are high vacuum and pressure impregnating plants, plastic dip tanks for coating processes now widely adopted for the protection of machined parts, and a range of small devices.—**Stand 8, Row C, Ground Floor, Grand Hall.**

Dial-type liquid level indicators, flow indicators, level controls and flameproof liquid level switches, and a float-actuated mercury switch unit suitable for chemical and petroleum industries are being displayed by BAYHAM, LTD. The main feature of these instruments is the glandless magnetic drive. Glands are thereby eliminated and the indicating or electrical switch mechanism is isolated from the tank contents.—**Stand 48, Inner Row, Gallery, Grand Hall.**

A remote operated Flowmatic type feedwater regulator, suitable for use where it is desired to locate the control valve at a remote point is the main feature of the display by COPES REGULATORS, LTD. The Flowmatic controller is mounted on the



Humidity test and climatic conditioning cabinet

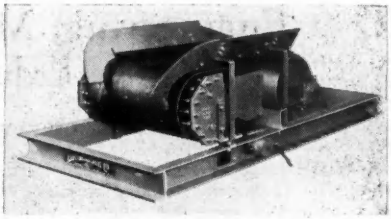
frame of the thermostat, both of these elements jointly actuating a pilot valve which varies the air loading pressure to a diaphragm operator. This in turn is connected to the lever of the control valve.—**Stand 29, Outer Row, Gallery, Grand Hall.**

Importance of research to industry is portrayed on the stand of the DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH which is combining with six other research associations connected with the engineering industry to provide a large exhibit illustrating the results of recently completed researches. The National Physical Laboratory demonstrates the properties of magnesium-cerium alloys for use at high temperatures. The Fuel Research Station shows a pilot-scale plant for recovering sulphur from power station flue gases with ammonia solution instead of lime, and also a multi-stage compressor with an output at 1,000 atmospheres. Interesting information on items of research for the foundry industry such as the improvement of methods of spectro-chemical analysis, the study of factors influencing the annealability of malleable cast iron and the factors influencing cavitation erosion of cast iron marine propellers is obtainable from the British Cast Iron Research Association. The association has appointed an Operational Research Team to visit foundries by invitation and to report, in confidence, any steps required to increase operating efficiency and production. —**Stand 35, Outer Row Gallery, Grand Hall.**

Instruments for measuring, recording and controlling temperature, pressure, draught and vacuum are displayed by the DRAYTON REGULATOR & INSTRUMENT CO., LTD. An item of interest is a dye vat regulator for controlling temperature to a predetermined rate of rise and holding at a pre-set maximum for any desired time.—**Stand 3, Row B, Ground Floor, Grand Hall.**

Rubber-lined chemical plant, solid ebonite pipes and fittings, rubber packings of all kinds and many other industrial applications of rubber are demonstrated by the General Rubber Goods Division of the DUNLOP Rubber Co., Ltd.—**Stand 9, Row D, Ground Floor, Grand Hall.**

A super intensity magnetic feeder unit (patent applied for) which, it is claimed, will revolutionise magnetic separation is the outstanding exhibit of ELECTROMAGNETS, LTD..



Magnetic feeder unit

The unit takes the general form of a short-band conveyor, but the conventional magnetic pulley which is widely used on such plants, is replaced by an entirely new magnetic head, round which is contoured the rubber and canvas conveyor belt. Limitations on space of magnetic circuit and windings, which are normally imposed by pulley or drum diameter, are completely removed and an intensity of magnetic field three or four times greater than that given by a magnetic pulley or drum of equal size is obtained. This new development enables relatively small separators to handle large outputs, thus reducing initial costs and economising space. Applications for which the new feeder is suitable are practically unlimited and cover many trades.—**Stand 17, Row J, Ground Floor, Grand Hall.**

Among its new products being shown by EVERSHED & VIGNOLES, LTD., are 'Dionic' purity meters for indicating steam purity and boiler concentration, the Evershed-Straub degassing condenser and a circular disc recorder. The Evershed-Straub degassing condenser removes non-condensable gases such as ammonia, carbon dioxide and hydrogen sulphide from steam or water so that a gas-free sample may be used for conductivity determination by 'Dionic' methods. These gases, while comparatively innocuous in the superheater and turbines, increase the conductivity reading to many times that due to inorganic salts and if retained in the water tested, completely mask their effect. By removing the gases, readings on the 'Dionic' meter require no correction and changing conditions are immediately apparent.

The new degassing condenser was originally developed by F. G. Straub, special research associate professor of chemical engineering at the University of Illinois, in conjunction with E. E. Nelson, and is now

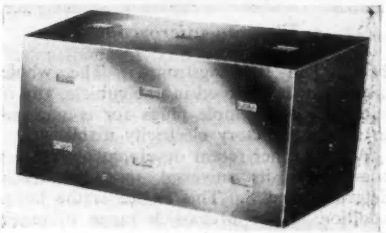
manufactured in England by the Evershed organisation, sole concessionaires for the apparatus in this country. It is of the latest design used by large power stations in the United States of America, Canada, and several European countries. The water tube unit of the purity meter and the Evershed-Straub degassing condenser are usually supplied mounted together in a steel cabinet, which can be mounted on skids for easy transit when required. When supplied separately the degassing condenser is usually covered by a metal shield.

Design of the circular disc recorder is intended for its use with various types of level and pressure transmitter. The instruments are of the moving coil type and are fitted with magnetic damping. The charts have a diameter of 10½ in. and a scale length of 4⅛ in. They are scaled in terms of the units transmitted and make one revolution in 24 hours, although seven-day instruments can be supplied. Spring or synchronous motor clocks are employed. The aluminium alloy cases which are splash-proof and dust tight, are suitable for flush mounting on a panel.—**Stand 6, Row Q, Ground Floor, National Hall.**

Exhibits at the GENERAL REFRACTORIES, LTD., stand cover the refractories requirements of all types of industrial furnaces. Basic refractories exhibited will include a comprehensive range of magnesite and chrome-magnesite bricks for open-hearth, electric and reheating furnaces, cement kilns and so on. Specially featured in this section is the exhibit of 'Ferroclad' metal-cased chemically bonded basic bricks in which the steel casing and the brick-material are pressed together by hydraulic pressure. Another interesting display is that of the G.R. '341' Dolomite Bricks, manufactured entirely from British Dolomite.

Fireclay Refractories include the well-known 'Glenboig', 'Davison' and 'Foster' ranges for boilers, locomotives, cement kilns, blast furnaces, hot blast stoves and industrial furnaces generally. Refractories for all types of suspended wall and roof construction are also displayed. Of particular interest is an exhibit of 'Amberlite' heat insulating products in which their function in reducing heat losses in furnace structures with resultant fuel economies is demonstrated. A full selection of high alumina, sillimanite and carbon refractories is exhibited together with many examples of fire cements, jointing materials and monolithic compositions. Also on view are samples of moulding and silica sands to meet every requirement.—**Stand 12, Row F, Ground Floor, Grand Hall.**

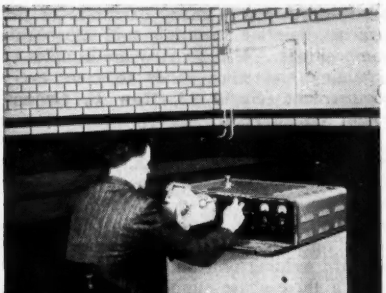
Welding equipment being demonstrated by the GENERAL ELECTRIC CO., LTD., includes the multi-operator welding transformer plant for serving up to six operators, and portable welding equipment of both the single operator and twin arc types. The twin-arc welding unit takes a balanced load from a three-phase supply and operates at a considerably higher power factor than the standard single phase equipments. Advantages include increased welding speed, ease of operation, less frequent rod changing, increased stability of the arc, improved finish of the weld, elimination of shock risk, and a cool electrode holder.—**Stand 6, Row V, Ground Floor, Empire Hall.**



'Ferroclad' metal-cased chemically bonded basic brick

Solvent, hydrocarbon and refrigerant proof c.a. jointing, c.a. jointing for organic and inorganic acids at highest temperatures and pressures, and reflex and double plate level indicators for the oil industry at w/p's up to 6,000 and 1,000 p.s.i. respectively, are included among the wide-range of equipment displayed by RICHARD KLINGER, LTD. —**Stand 1, Row C, Ground Floor, Grand Hall.**

Although based on experience accumulated from the new well-known Types EM2 and EM3 electron microscopes, the EM4 microscope being shown by METROPOLITAN-VICKERS ELECTRCAL CO., LTD., bears no physical resemblance to its predecessors. It has been designed particularly as an inexpensive instrument for routine work in factory or laboratory. It will provide magnifications up to 12,000 with a resolution



Electron microscope

better than 100 angstroms. The whole instrument is enclosed in one cubicle, and is equipped with simple plugs for connection to standard factory electricity mains.

Among other recent developments by this company is its universal magnetic crack detector, type S. This device is the latest addition to the Metrovick range of crack detectors and is already in use in many branches of engineering. The 'current flow' and 'magnetic flow' circuits enable cracks lying in all directions to be detected in a single operation, and both circuits can be used for demagnetising. Components up to 5 ft. in length can be treated in the machine. A special feature is the continuous control of both magnetising circuits.

Another improved design on view is an air-operated spot welder, type As.60. Two machines of this type are displayed, one with the covers removed. The complete machine provides a noteworthy example of the modern trend of appearance design, special consideration having been given to pleasing lines and ease of cleaning. The machine without covers shows the robust construction of the equipment, but its principal purpose is to emphasise the ready accessibility of all components for maintenance purposes; this requirement was the deciding factor when positioning the main contactor, thyratron timer, neon timber, sequencing relays, magnet valve and differential pressure switch.—**Stand 6, Row J, Ground Floor, Grand Hall and Stand 8, Row V, Ground Floor, Empire Hall.**

History of nickel since its discovery by the Swedish scientist Cronstedt, 200 years ago, is the theme of the display by the MOND NICKEL CO., LTD. Individual exhibits include a model of Cronstedt's laboratory, copies of classic papers in the history of the nickel industry and photographs and drawings of production equipment and plant. Examples of uses of nickel and its alloys are shown. A full range of technical publications on the properties and uses of nickel and nickel alloys are available.—**Stand 2, Row G, Ground Floor, Grand Hall.**

Chemical products of particular interest to the foundry and engineering industries are being shown by MONSANTO CHEMICALS. The use of ethyl silicate as a bonding agent in the process of investment or precision casting is well known. A product under the name of Silester O. Syton C, an aqueous suspension of silica in colloidal form, is offered as an alternative agent in this process. In the recent and important development of using ceramic moulds for the production of small numbers of castings in high melting alloys, where the quantities involved would not justify the production of steel dies, ethyl silicate is again the recommended bonding agent, giving a finish equivalent to that obtained in gravity die-casting. Silester O is available for this purpose, as is also Silester A, an amine-modified ester.

In addition to the Silesters a range of products of value as heat exchange media or as hydraulic fluids is displayed. This group comprises alkyl and aryl silicates and a number of chlorinated diphenyls known as the Aroclors. These products are supported in the exhibit by cresylic acid for engine cleaning, pentachlorophenol for timber preservation and sodium benzoate for metal corrosion inhibition.—**Stand 16, Row J, Grand Hall.**

An interesting feature of the crucible furnaces being shown by THE MORGAN CRUCIBLE CO., LTD., is a recently developed mechanised central axis tilting furnace (type CA. Mech). The principal advantage of this type of furnace, which is being shown for the first time, is the ease of handling and the consequent reduction in operating and production costs.—**Stand 1, Row A, Ground Floor, Grand Hall.**

Improved models of metallising guns for use on the reclamation of worn or mis-machined parts and the application of anti-corrosive coatings are being shown for the first time by THE METALLISING EQUIPMENT CO., LTD. These are the new Metco metal spraying guns, types 4E and 5E.

Type 4E is a universal gun, capable of depositing all metals in wire form. Among its outstanding design features are: a siphon-jet to balance the gases, a light-weight aluminium gas-head, a built-in oil pump, and the METCO automatic wire speed governor. It is primarily intended for the rapid reclamation of worn or mis-machined parts. Using this equipment with Metco Sprabond Metallising Wire, a physico-chemical bond of great strength is easily obtained.

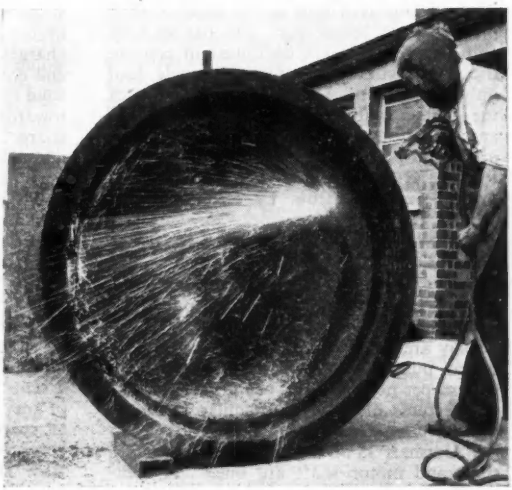
Type 5E gun, which incorporates the new design features of the 4E has been specially produced for high-speed spraying of anti-corrosive coatings using 3/16-in. dia. wires. It will apply .001 in. of zinc or aluminium on 1,200 sq. ft. of steel in one hour, the cost of the spraying process (exclusive of metal used) being approximately ¼d. per sq. ft.—**Stand 11, Row A, Ground Floor, Grand Hall.**

Many new exhibits of outstanding interest are being shown on the stand of MUREX WELDING PROCESSES, LTD. These include a new 50 amp. transformer welding equipment, newly-designed 250 amp. transformer equipment, a recently developed low voltage device for a.c. welding equipment, the Elin-Murex Automatic Welding Equipment, and some new types of electric arc welding electrodes.

Among the other types of Murex electric arc welding equipment being shown are some engine driven sets which have been specially prepared with cut-away sections to show the internal components. The exhibit is completed by a display of Murex arc welding electrodes, the range of which now covers over 70 different types.—**Stand 5, Row W, Ground Floor, Empire Hall.**

Modern industrial applications of glass are demonstrated on the stand of PILKINGTON BROTHERS, LTD. The exhibit is designed round a tall electric pylon displaying strings of 'Insulight' toughened glass high voltage insulators of many types now available. 'Insulight' sealed double-glazing units are also displayed to demonstrate thermal insulation.—**Stand 8, Row F, Ground Floor, Grand Hall.**

The Twin-Arc welding process is being demonstrated by THE QUASI-ARC CO., LTD., using twinned electrodes. The company announces that arrangements are now in hand with The General Electric Co., Ltd., Witton, Birmingham, under which The Quasi-Arc Company will be the sole concessionnaires throughout the world for the G.E.C. Twin-Arc Metallic Arc Welding Process.—**Stand 8, Row W, Ground Floor, Empire Hall.**



Oxyarc cutting showing the application of the Oxyarc process to the cutting of heavy section cast iron water mains (Rockweld Ltd.)

Progress made by ROCKWELD, LTD., during the two years since the last exhibition is demonstrated on the company's stand by the wide variety of new welding plant and electrodes on view.

A new type of mild steel electrode has been developed named Silvac. This electrode is notable for its ease in use, particularly for overhead welding. The manipulation on downhand welding is also exceptionally easy. Apart from the normal running technique, the electrode can also be used for contact welding, producing a smooth finish which can be varied in contour from slightly convex to flat and, overcoming the general weakness of this type, giving adequate penetration. The manipulation for vertical welding is much easier than for a general purpose electrode, if not quite so good as the special Vertend type. The slag produced by this electrode is self-releasing, making the electrode eminently suitable for pressure vessel work.

The Oxyarc process of cutting has shown steady advance, and a notable development in one of its many applications has been in cutting of cast iron gas and water mains, in sizes up to 4 ft. in diameter, and up to 2 in. in thickness where it is said to halve the time of cutting compared with any other methods. A new Oxyarc gun holder has been developed incorporating many features of outstanding importance. The gun is all-insulated and metal clad. The oxygen seal is of an improved type giving better sealing properties and longer life. The oxygen hose and electric cable are combined in concentric construction, thus giving a single lead only to the gun. Electrical conductivity of the contact with the electrode is improved, and a chuck type of electrode grip gives quick and positive engagement. The operator's hand is protected by a substantial shield.—**Stand 3, Row U, Ground Floor, Empire Hall.**

Diaphragm valves in types and sizes to suit all industries are exhibited by SAUNDERS VALVE CO., LTD. Linked with the valve exhibit in a most practical manner, by delivering the fluid flowing through the 'live' display are two 1½ in./2 in. Safran self-contained pumps. Each unit delivers 2,280 gallons per hour at 10 ft. head. The overall compactness of these and similar (self-contained) pumps exhibited is attributable to the Unishaft construction in which pump shaft and motor shaft are one. A split-impeller Safran pump is built for breweries, dairies, foodstuff factories or where access to 'wet' parts is essential.—**Stand 9, Inner Row, Gallery, Grand Hall.**

Special plastic tiles, displayed for the first time at a trade exhibition, are a feature of the Semtex stand. The tiles, of great durability and with a wide range of decorative possibilities, have been designed to meet the demand for a superior finish at a reasonable cost. Many other Semtex materials to be exhibited are now being used on a large scale in current building and re-equipment work. They include Semastic decorative tiles, domestic tiles—which have been specially produced for the building industry—jointless fleximers, and inlaid rubber and linoleum. Industrial fleximer surfacings and types of specialist anti-corrosion treatments will also be displayed by the Industrial Division of Semtex. A comprehensive flooring service, including advice on the installation and maintenance of many types of surfacings, is being offered by the firm.—**Stand No. 101, Row E, Grand Hall.**

A wide range of centrifuges is being exhibited by SHARPLES CENTRIFUGES, LTD. The Sharples Super-D-Canter is a new type of solid basket centrifugal for handling continuously any suspension of fine crystals or amorphous solids in a liquid. A horizontal shaft carries a solid basket within which is mounted a ribbon plough rotating slightly slower than the basket itself. The liquid suspension is fed at a point about mid-way in the basket. The clarified liquid discharges over a series of weirs in the larger end cover of the basket, while the separated solid matter is moved forward by the plough towards the smaller end, where it is discharged. The action is entirely continuous and automatic, requiring no periodical cleaning and no control after the initial adjustments have been made.

Sharples Laboratory Super-Centrifuges have been extensively adopted as standard equipment for research and industrial laboratories. Two types of the open model are shown, one with electric motor and the other with turbine drive, suitable for either steam or compressed air. The motor driven machines operate at 23,000 r.p.m. generating a centrifugal force of over 13,000 times that of gravity, while turbine driven machines run at speeds up to 50,000 r.p.m. at which a force of 62.000 'g' is produced.—**Stand 5, Row D, Ground Floor, Grand Hall.**

International Research Institute

Battelle to Operate on Continent

THE Battelle Institute of Columbus, Ohio, is to establish an international research organisation to serve the European economy. It will be known as Battelle International Institute and is intended to serve European industry on a non-profit basis. Research will be carried out in existing research institutes in Europe, and in European universities and technical colleges, but separate laboratories will also be established in various parts of the Continent as soon as present negotiations are completed.

As with the parent organisation, financial support for these activities will be derived from industrial sponsorship, from endowment, and from income from patents owned by Battelle. It will conduct research in the fields of applied chemistry and physics, metallurgy, fuels, ceramics, electronics, theoretical and applied mechanics, the engineering sciences, and agriculture.

Executive Director

Mr. J. S. Crout, for many years assistant director of Battelle, has been named executive director of the new institute. In discussing the results of a recent survey of scientific and industrial conditions in Europe made by Mr. Crout, Dr. Williams, director of Battelle, commented, 'The progress of European industry in re-establishing itself amazes us. We are encouraged by the energy with which Europeans are continuing this effort. We share the confidence of Europe that industrial research can accelerate this regeneration. From this we are encouraged to anticipate the growth of our research in Europe to an annual budget in excess of $1,000,000 within three years'.

'The accumulated knowledge and experience gained through Battelle's service to American industry can do much to help industry in Europe increase its productivity, expand its markets, and reduce costs,' Dr. Williams said. 'At the same time, the establishment of research projects in Europe will create increased opportunities for European scientists and engineers to work more effectively in their chosen fields. They will thus contribute more fully to the welfare of their countries. We believe further that the establishment of an international research centre, in which scientists and engineers from all nations may work together and exchange ideas and methods, will do much to promote world peace by encouraging understanding and friendship among technical men of all nations. We look forward to this opportunity to increase our service to mankind throughout the world'.

Mr. Crout has helped to pilot Battelle Institute through its period of greatest expansion to become the world's largest independent industrial research laboratory. He joined the executive staff of Battelle in 1941 when he took charge of administering the institute's programme of research.

Battelle Memorial Institute was founded and endowed to serve mankind through the application of science to the problems of industry. Since 1929, at its laboratories in Columbus, Ohio, it has served the industry of America and of other continents. It has, currently, a staff of 1,600 scientists, technologists, and their assistants. This year it will conduct an estimated $9,000,000 worth of research.

Battelle's fields of research include: production engineering, mechanical engineering, industrial physics, metallurgy, chemistry, chemical engineering, ceramic technology, graphic arts technology, welding technology, electrochemistry, air and stream pollution, mineral processing, engineering economics, electrical engineering, fuels and combustion, agricultural sciences, plastics, rubber and paints, electronics, theoretical and applied mechanics, and nucleonics.

Food Problems Conference

A joint conference of the Food, Agriculture and Fine Chemicals Groups of the Society of Chemical Industry on 'Problems Arising from the Use of Chemicals in Food' will be held in the Wellcome Research Institution, 183-193 Euston Road, London, N.W.1, on Thursday and Friday, 27-28 September.

Among the subjects to be dealt with are surface active agents and emulsifiers, preservatives, antioxidants, flour and bread improvers and flour bleachers, colouring matters, flavours, agricultural, inorganic and organic residues.

Iron & Steel Scrap Prices

Increases to Stimulate Collection

THE Minister of Supply has made an Order (Iron & Steel Scrap (No. 4) Order, 1951) increasing from 27 August the controlled maximum prices of Iron and Steel Scrap.

The increase is £2 per ton except for compressed destructor scrap and two lower grades of unprepared process scrap. For these three grades the increase is 30s. per ton.

The purpose of the higher prices is to stimulate the collection of ferrous scrap. This is an urgent need in view of the decline in the supplies of imported scrap and the great importance of increasing steel production. A small part of the increase is needed to defray increased costs of collection, processing and handling, particularly in the case of the smaller merchants and in the more remote areas. Subject to this, the Scrap Merchants' Federation have given an assurance that the increase will be passed on to the owners of scrap so as to encourage them to return as much as possible. The scrap merchants have also assured the Minister that the rise in scrap prices will secure a substantial increase in the recovery of scrap.

The Iron and Steel Corporation of Great Britain and the British Iron and Steel Federation support the price increase. The new Order is regarded as fixing the maximum prices of ferrous scrap for some years ahead.

With the exception of two special grades of iron, the controlled prices of finished iron and steel are not being increased to consuming industries, but some adjustments are necessary, within the steel industry itself, in the prices of semi-finished steel. The Minister has made an Order accordingly (Iron & Steel Prices (No. 3) Order 1951) also taking effect on 27 August.

The Minister is appealing to all in industry, from large factories to small workshops, and to local authorities, to farmers and householders, as well as to the scrap merchants, to make every possible effort in the national interest to secure the maximum increase in the supply of scrap.

Copies of the Orders will be available from H.M. Stationery Office and booksellers.

Apart from small increases mainly to meet additional transport costs, delivered prices of iron and steel scrap have been kept stable since 1937. The maximum prices for iron and steel scrap, other than alloy steel, have ranged from 41s. 5d. to 189s. 4d. per ton, but in the main have not exceeded £5 per ton. Recently there have been indications that the low price was beginning to affect the volume of scrap flowing back to the iron and steel furnaces.

Imports of scrap mainly from Germany have fallen from nearly 2 million tons per annum in 1949 and 1950 to an annual rate of less than 700,000 tons in the first half of 1951.

Increased supplies of scrap resulting from this price rise will provide an additional volume of a relatively cheap raw material to the iron and steel industry, which, together with the economies resulting from increased steel production, will help to offset the increased cost of scrap. The iron and steel industry has therefore agreed to carry the immediate effects of the increase in scrap costs. The engineering and other steel consuming industries on the other hand will benefit appreciably from the increased price for their scrap.

Scrap is also used largely in the foundry industries. There will be no increase in the prices of those foundry products which are subject to price control, and the Ministry considers that in the main it should be possible to avoid any general increase in the field of uncontrolled products also.

The price increases covered by Iron and Steel Prices (No. 3) Order are:—

Cylinder and refined iron	25s. per ton
Cold blast pig iron	15s. „ „
Semi-finished steel:—	
Billets	5s. „ „
Sheet and Tinplate bars	7s. 6d. „ „
Forging ingots	25s. „ „

Missions Sponsored

The Economic Cooperation Administration and the Organisation for European Economic Cooperation have contracted to sponsor three 'technical assistance missions' for inclusion at the World Metallurgical Congress in Detroit, 14-19 October.

The new groups add another 100 top scientists and metal producers anticipated at the congress and concurrently staged 33rd National Metals Exposition and Congress, which together are expected to draw more than 40,000 metal engineers and executives. More than 400 ECA and non-ECA metallurgists from 21 nations are now expected in Detroit.

Methane Gas Projects

More Italian Ammonia to be Made

THE shortage of coal and electricity has given a stimulus to projects for the expansion of oil refining and natural gas production in Italy. The throughput capacity of the Italian oil refineries is to be raised from the present 5,000,000 tons a year to 8,115,000 tons, and the production of natural gas which has more than trebled in two years and now amounts to 2,500,000 cubic metres a day is to be raised to 10,000,000 cubic metres by the end of this year.

Meanwhile measures are being taken to make increased use of refinery by-products and natural gas for chemical purposes. The two petroleum refineries at Bari and Livorno which formerly belonged to ANIC (Azienda Nazionale Idrogenazione Combustibili) and since last year are operated by STANIC in which Standard Oil of New Jersey and ANIC are financially interested are already making aliphatic compounds, including fatty acids, from ethylene, propylene, butylene and isobutylene extracted from the refinery gases and will soon extend the range of their chemical manufactures.

ANIC, which acquired substantial interests in the Italian chemical industry last year when it took over a number of share parcels formerly belonging to I. G. Farbenindustrie, intends to develop its chemical activities. In co-operation with AGIP (Azienda Generale della Industria Petrolifera) which is by far the largest producer of natural gas in the Po Valley, ANIC is considering the erection of a large plant for the synthesis of ammonia from natural gas; a new cheap process for the production of nitrogenous fertilisers from the ammonia thus obtained has been developed, according to the latest annual report of ANIC, and the project is said to enjoy the support of agricultural circles. Two other companies, Societa per l'Industria e l'Elettricita and Montecatini, are now engaged on the erection of similar plant for the production of ammonia from natural gas (*see* CHEMICAL AGE, No. 1676, page 263).

The importance of the use of natural gas for the production of fertilisers has been acknowledged by the grant of ECA funds for the two last-mentioned projects, and it is hoped that U.S. loans will also be available for the ANIC-AGIP project. The Italian fertiliser production has made steady and continuous progress since the war, but Italian agriculture could absorb even larger quantities of nitrogenous fertilisers, and Montecatini has been able to develop an export market for ammonium sulphate. Synthetic ammonia accounts for approximately 90 per cent of the Italian nitrogen production.

Phillips' 60th Anniversary

NOW enjoying a reputation as one of the leading electro-technical firms of the world with factories in dozens of countries and an employment roll of 80,000, Messrs. N. V. Philips' Gloeilampenfabrieken, of Eindhoven Holland, are this year celebrating their 60th anniversary.

At its inception the firm of Messrs. Philips' employed 25 men and confined its attention to the manufacture of incandescent lamps for the Netherlands market but they soon started exporting to other European countries. Although electric bulbs still constitute the bulk of the firm's output, to-day Philips' make a wide range of electro-technical products and have also greatly increased their activities in various branches of the chemical industry. Both research and development are being pursued in plastic materials and in the field of solids, including ceramic materials for electro-technical purposes and new substances with special electrical and magnetic properties. Research is also being conducted and production increased in pharmaceutical products while other activities have included a new photochemical system for reproduction purposes.

The organisation now has its ramifications in all the countries of Europe, and, indeed, in most countries of the world. Some of its overseas branches assemble component parts imported from Eindhoven but in many cases they are completely self-contained.

Freed at Last

After 30 September next Chile nitrate will no longer be imported on public account, the Ministry of Materials announced last week. Chile nitrate has been imported by the Nitrate Corporation of Chile which has acted as agents of the directorate of nitrogen supplies for the last ten years. The directorate, formerly under the Board of Trade, is now part of the recently established Ministry of Materials.

Huge Sulphur Deposits

New Discovery May Solve Problem

THE discovery of huge sulphur deposits in the marshes of the Mississippi River delta, 100 miles south-east of New Orleans, was announced on 23 August when it was stated that they were large enough to help end the world shortage within two years.

The deposits were found by the Texas Company which was drilling for oil in the swamps and plans have already been made for the Freeport Sulphur Company to build on a 1,000-acre site in the locality. A plant designed to produce 500,000 tons a year is planned and should be in operation by the end of 1953. The plant will cost between £3,000,000 and £5,000,000.

Commenting on the discovery, Dr. James Boyd, director of the Bureau of Mines and head of the Defence Minerals Administration, said: 'There will still be a shortage until 1953, but after that we should be in the clear'.

'This means there is now in sight enough new production of this essential mineral to solve the free world's sulphur shortage'.

Dr. Boyd put the world deficit at a million tons a year. He explained that steps had already been taken to increase output by 500,000 tons a year. The unexpected find at the mouth of the Mississippi should make up the rest of the deficit.

H_2SO_4 Plants Ready Soon

THE Ministry of Materials announced on 22 August that the first three of the 18 sulphuric acid plants which are now under construction in Britain will be ready to go into production at Grimsby in October.

Two more will start production at Grimsby in May next year. All 18 plants are owned, and will be operated, by companies. Some are extensions of existing plants.

Of the remaining 13 plants two will be ready at King's Lynn, Norfolk, between November and December and four in Flintshire early next year. Production dates for two each at Widnes, Lancs, Castleford, Yorks, and Ardeer, Scotland, and one in Anglesey, are not available.

Most will use pyrites and the remainder the anhydrite process. Two plants are being made for export to Greece.

It is expected that by 1954 the total of sulphuric acid produced in Britain by these processes will have risen from 280,000 tons to 900,000. Imports should be reduced by 50 per cent by 1956.

To Make Plastics in Japan

IT has been announced that the Monsanto Chemical Company, St. Louis, U.S.A., on 15 August formed an associated company in Japan with Nipponkasei Chemical Industries, Ltd., of Tokyo.

Charles A. Thomas of St. Louis, president of Monsanto, has said the new company, Monsanto-Kasei Kogyo, K. K., will operate plants at Yokkaichi and Nagoya for the production of plastics and other chemicals.

The company, formation of which has been approved by the Japanese Foreign Investment Commission, will manufacture vinyl chloride monomer, Ultron polyvinyl chloride resins and compounds, and Santicizer 160, a Monsanto plasticiser used in the manufacture of vinyl plastics. Two plants, which recently were completed by Nipponkasei, will be expanded to provide facilities for the new products.

Nipponkasei also operates a large factory at Kurosaki, Kyushu, where it produces fertilisers, coke, dyestuffs and pharmaceuticals.

Monsanto entered the vinyl chloride market in the United States in March, 1947, following three years of extensive pilot plant production. Since that time the company has been making the product at its plastics division plant at Springfield, Massachusetts, under the trade name Ultron. The plastic is also produced at Monsanto's Montreal, Canada, plant and in May, this year, the company announced the formation of a Brazilian subsidiary to produce the same material.

Operations of the new Japanese company will mark Monsanto's first manufacturing in the Orient. American technical personnel will be transferred to Japan to take part in the management.

We have been informed that all correspondence for the Director of the New Zealand Fertiliser Manufacturers' Association should be addressed to him, c/o the Association, Otara Road, Papatoetoe, Auckland.

Plastics Education Fund

Trustees Appeal for Contributions

IN 1942 the President's Fund was formed for the promotion of education within the plastics industry. Since that time a great deal has been accomplished. In particular, scholarships and training grants have been awarded; support given to universities and technical colleges; a scheme of apprenticeship within the plastics industry instituted and a large number of monographs of scientific and technological subjects published.

Covenants Expire

Most of the income of the President's fund was provided by seven-year covenants which have now expired and in order that this work may continue, and, if possible, be expanded, the trustees are launching an appeal for subscriptions to establish a new fund called the Plastics Industry Education Fund. This, it is hoped, will provide a minimum income of £4,000 a year for educational purposes. Intending contributors can make annual subscriptions under seven-year deeds of covenant, deducting tax at the standard rate of income tax in force from the gross annual payments under the deeds, or they can make donations in the ordinary way. From the point of view of the fund seven-year deeds of the covenant are preferable, both because they provide an assured income and because the objectives of the fund can be regarded as charitable, so that the Trustees will be able to recover the tax deducted by the donors.

A new deed is being drawn up to form a trust to administer the money received, and new trustees approved by firms who subscribe to the fund will be appointed. It is intended that the Plastics Institute shall be the executive body to administer the fund in accordance with the decisions of the trustees as to how the money is to be spent.

This appeal has the full support of the Council of the British Plastics Federation, the Council of the Plastics Institute and the trustees of the President's Fund of the Institute. It is hoped that all firms interested in the plastics industry will support the new fund to the fullest extent possible. Subscriptions may be sent to the Trustees of the Plastics Industry Education Fund, c/o The Plastics Institute, The Adelphi, Adam Street, London, W.C.2.

IN THE EDITOR'S POST

Fluoride Tooth Paste

SIR,—We understand that you are very interested in the reaction of sodium fluoride upon dental decay, and we therefore think it appropriate to draw your attention to our fluoride medicinal tooth paste, 'Sanogyl.'

The base of this is arsenobenzol and fluorides and its efficacy in arresting dental decay is well-known to the dental profession and would be confirmed by any qualified dental surgeon, who to the number of several hundreds have individually written to the Home Secretary as long ago as 1938 stating that they recommended the daily use of 'Sanogyl' as an efficient and safe dental preparation.

As the enclosed leaflet on fluor therapy shows, we were using fluorides in the manufacture of our products long before the Americans came to the conclusion that it was worth while giving it a nation-wide application and especially for young children.

Yours faithfully,

L. ZISSERMAN.

Sealand Trading Ltd.

Editor's note: Mr. Zisserman, who is a director of Sealand Trading Ltd., is apparently referring to the leading article 'Teeth and Fluorides' which appeared in our issue of 28 July, parts of which were subsequently published in 'The Daily Mirror'.

New Anhydrite Sources

CONSIDERABLE interest has been shown in Holland, in respect of deposits of anhydrite ranging in thickness from eleven to sixteen metres which have been located at a depth of approximately 280 metres superimposed on the salt deposits at Weerselo and Schoonlo.

The fact that Holland's home production of cement at 600,000 tons meets approximately only half her full requirements and also that the Netherlands have to import almost the whole of their supplies of sulphur and sulphur products has led to the investigation of the newly found deposits by the Dutch Central Institute for Industrial Development. As a result it is estimated that four plants costing 100 million Dutch florins would be required to exploit these resources. Expected output would be 600,000 tons of anhydrite annually valued at approximately 64 million Dutch florins.

Metallurgical Section

Metallurgy at Edinburgh

'The Strength of Metals' & 'Recent Metals & Alloys'

The following is an abstract of a paper read to the Chemistry Section of the British Association at Edinburgh on Tuesday, 14 August, by Professor A. H. Cottrell of Birmingham University on 'The Strength of Metals':—

IN a ductile metal the yield strength and fracture strength both depend on the process of plastic deformation that takes place in its constituent crystals. It is well known that a metal crystal deforms plastically by the sliding of one piece of crystal past another on certain crystal planes (slip planes), and in certain crystal directions (slip directions). Because the slip direction is crystallographically determined, even when the maximum resolved shear stress acts in other directions in the slip plane, the material in the slip plane evidently remains crystalline when slip takes place.

The atoms in a slip plane cannot all slip simultaneously over their neighbours in the next plane; slip must begin at certain places and then spread through the rest of the plane. It is thus possible, in principle at least, for us to draw lines in an active slip plane marking out the boundaries of regions where slip has occurred to the extent of 0,1,2 . . ., etc., lattice spacings. We call these boundary lines 'slip dislocations'.

Important Properties

The structure and properties of slip locations can be deduced from the theory of elasticity and from considerations of lattice geometry. Three properties are particularly important: (1) When a slip dislocation is moved in a slip plane, the amount of plastic deformation in the crystal is altered; (2) the stress needed to move a dislocation through a slip plane of an otherwise perfect crystal is smaller than the lowest observed yield strength; (3) the stress needed to create a dislocation in a perfect lattice is larger than the highest observed strength.

This last property implies that slip dislocations must be present in the crystal before it is subjected to a plasticity experiment. Support for this idea is provided by a recent theory of crystal growth (theory of Frank), which shows that imperfect crystals containing dislocations will grow more quickly than perfect ones. This theory predicts that growth takes place by deposition along spiral terraces on crystal faces, the centre of each spiral being the point where a dislocation line emerges from the interior of the crystal. Recent observations of such growth spirals on inorganic crystals provide striking confirmation of this theory.

Dislocation Lines

The dislocations formed during crystal growth are not constrained to lie in slip planes. Such a dislocation line may follow an arbitrary path through the crystal, some parts lying in slip planes and so constituting slip dislocations, while other parts do not lie in slip planes and are immobile. A slip dislocation which is part of a more general dislocation line is anchored to the point ('point of emergence') in its slip plane where the line turns out of the plane into some immobile orientation. It can therefore glide in its slip plane only by rotating about this point of emergence, rather as the hand of a clock glides in the plane of the clock face by rotating about the centre. The number of rotations which can occur is limited only by boundary conditions, and this is consistent with the observed fact that the amount of slip on active slip planes can be very large, of the order of 1,000 lattice spacings. The analogy with the hand of a clock is not perfect; the dislocation line will curl up into a spiral as it rotates, because, for a constant linear velocity of the dislocation, the angular velocity is greatest for those parts that are nearest to the point of emergence.

Under certain circumstances this rotating dislocation may climb from one slip plane

to the next as it rotates, in which case the plastic deformation is not concentrated into a single active plane, but is spread homogeneously through a sequence of planes. This is most likely to occur when the slip dislocation produces a slip of less than one lattice spacing each time it moves through a plane. It may be the mechanism whereby deformation twins are formed.

Due to Imperfections

Since a perfect lattice offers little resistance to the motion of a slip dislocation, the observed hardness of metals must be due to imperfections in the structure which obstruct the dislocations. Various kinds of obstacles may be encountered and affect dislocations in different ways. Mobile impurity atoms in solid solution may migrate to resting dislocations and anchor them firmly to their initial positions. A large stress is then needed to break the dislocations away from these positions, but once they have broken away they can be moved easily by smaller stresses. The material should therefore soften suddenly at the start of plastic deformation. This 'yield phenomenon' is observed in soft iron which contains carbon and nitrogen.

Immobile solute atoms which are dispersed as individuals or clustered together into precipitates offer a resistance to dislocation that is statistically independent of their position in the crystal. No yield phenomenon is observed, but the crystal is hardened because the dislocation has to be driven through the internal stress fields caused by these particles. A critical size of dispersion exists at which the hardening is a maximum. If the dispersion is too fine, the random stress fields acting on the dislocation practically cancel one another, and there is little hardening. If the particles are too far apart, the dislocation is able to curl between them and 'by-pass' them, and again there is little hardening.

Grain boundaries form strong obstacles to the passage of dislocations. Slip can be transmitted from one grain to another, however in the following way. If a sequence of dislocations, in an active slip plane, approaches a grain boundary, the pressure of the members of the sequence against their leader, which is obstructed by the boundary, causes a large intensification of stress in the neighbourhood of the obstruction. When the number of dislocations in the sequence is large (1,000 is a reasonable value), the stress is enlarged so much that slip is forced to take place in the crystal on the other side of the boundary. The number of dislocations that can be piled up in a slip plane increases both with the applied stress and with the length of that plane, that is, with the grain size. It follows that grain boundaries are less effective as boundaries when grain size is large.

Strain hardening is proving to be one of the more intractable problems facing the theory. It depends upon the group behaviour of the large number of dislocations created during plastic flow. Recent experiments suggest that the initial dislocations tend to assemble into sheet-like arrays, roughly perpendicular to the slip direction, where they are firmly locked by their mutual interactions. These sheets act as barriers to the propagation of later dislocations, and, as more dislocations gather up in them, they become observable under the microscope, where they are known as deformation bands. We do not as yet fully understand how these special arrays of dislocations are formed in the first place, or why they should be so stable mechanically, but there are strong reasons for believing that they are the main cause of strain hardening.

Recent Metals & Alloys

THE following is an extract of a paper on 'Recent Metals and Alloys' read by Professor A. C. Quarrell, of Sheffield University, to the Chemistry Section on Tuesday, 14 August:—

Many operations in the production and working of metals are only possible because the engineer provides the metallurgist with the powerful and sometimes elaborate machines that are required. It is equally true to say that many of the achievements of modern engineering would not have been possible had not the metallurgist developed new and improved alloys with properties suitable for their particular application.

Whereas engineers at first based their designs upon known alloys, they now tell the metallurgist what combination of properties is required to permit optimum, or at least efficient, performance of a given machine. The metallurgist is by now quite familiar with the technique and knows only too well that as soon as he has provided what he was asked for, more exacting demands will be made. Much of the metallurgical activity of

this country is, in one way or another, concerned with meeting such demands.

For most of the five or six thousand years that metals have been used by man, metallurgy has been an art rather than a science and new alloys have resulted from chance observation rather than from deliberate effort. The last few years have seen vast strides in our understanding of the theory of alloys, but unfortunately the alloys which are most important technically are extremely complex and industrial practice still outstrips theoretical understanding. As a result, alloy development is still largely empirical and the rapidity with which existing alloys are improved and new alloys developed is due mainly to the magnitude of the effort being made and to the skill of the metallurgist in exploiting to the full any beneficial effects he observes as a result of changes in composition or in heat treatment.

The needs of the aircraft industry for alloys of high strength-to-weight ratio suitable for air-frames and for alloys capable of withstanding high stresses at elevated temperatures in aero-engines have provided the incentive for the steady improvement of light alloys and of the special alloy steels. High-strength aluminium alloys of the aluminium-zinc-magnesium-copper type are the most recent in the line of descent from Wilm's duralumin and form a large part of most modern aircraft.

Greatly improved properties coupled with the low density of magnesium have became available in the last few years with the introduction of the magnesium-zirconium-zinc alloys; the zirconium exerts a powerful grain-refining effect, reduces the microporosity which was such an undesirable feature of earlier alloys, and facilitates both hot and cold working.

Steady Improvement

Alloys suitable for use at elevated temperatures as in the gas turbine have been the subject of much discussion recently, and on the whole the tale is one of steady improvement of known alloys rather than of the discovery of alloys of quite new types. Austenitic steels, particularly an alloy containing nickel, chromium, cobalt, tungsten, molybdenum and columbium, have given successful service as gas turbine discs under conditions of high stress and high temperature. Ferritic steels have been continuously improved and there are now alloys with creep and scaling resistance almost approaching those of the austenitic steels, and much more economic because of their lower alloy contents. Alloys based on the 80/20 nickel-chromium alloy with the addition of titanium and aluminium have proved most successful for use as gas-turbine rotor blading, and continuous research by a large team has enabled the maximum working stress and temperature of such alloys to be raised repeatedly.

Copper alloys are also affected by the requirements of the gas turbine. Light alloys are extensively used for compressor blading, but the higher working temperatures involved in contemporary design is causing special interest to be shown in the complex aluminium bronzes. The single phase aluminium bronzes are similarly of interest in connection with the heat exchangers which form an essential part of long-life gas turbines suitable for marine or land installations.

Copper-Base Alloys

Full information has recently been published concerning the copper-nickel-iron alloys that were developed to meet the exacting requirements of the navy at war. Copper-base alloys containing up to 10 per cent nickel and up to 2 per cent iron can be worked almost as readily as copper by the techniques used by the coppersmith, and yet have excellent resistance to the impingement type of corrosion attack caused by seawater containing entrapped air. These alloys have already shown their value for auxiliary piping in ships, and in the U.S.A. at least, they are being advocated for use as condenser tubes.

Systematic study of the effect of alloying additions upon the properties of cast iron has considerably extended their field of usefulness, but even more important, potentially, is the development of nodular cast iron which has resulted from a scientific study of the mode of graphite formation. By adding to the ladle small amounts of cerium or magnesium the iron can be made to solidify with the graphite in nodular instead of flake form, and the mechanical properties are comparable with those of steel, although the excellent casting characteristics of normal cast iron are retained.

Some of the metals hitherto considered only as alloying elements are becoming of increasing interest as the possible bases of

new systems of alloys. Thus, certain chromium-rich alloys have good creep properties at temperatures as high as 900 or 1,000°C., although their practical use is prevented by their extreme brittleness at ambient temperatures. Again, in recent years ductile titanium has become available in reasonably large quantities for the first time and much effort is now being devoted to assessing its potentialities.

Titanium is relatively light—it has a specific gravity of 4.5—its resistance to corrosion by chloride solutions is excellent; its tensile strength is greater than that of mild steel and can be further increased by alloying. Large quantities of titanium ores are available and if improved large-scale methods of extraction can be devised, a new and important industry will almost certainly grow up, helping to relieve the shortage of those metals that we have for so long taken for granted.

Oxidation of Magnesium

High Temperature Tests in U.S.S.R.

AT the Research Institute of Technology and Industrial Organisation (Russia) work on the oxidation of magnesium, aluminium zinc, and alloys has been recently undertaken, and results are described by I. A. Makolkin (*Zhurn. Prikladn. Khim.*, 1951, *24* (5), 460-470). The tests were made in atmospheres of air, nitrogen, carbon dioxide and sulphur dioxide, and the method used was that of adsorption weights earlier described (*Zavodsk. Lab.*, 1949, *10*, 1209). This was preferred for various reasons to the usual method with an analytical balance or micro-balance.

In the case of SO_2 special apparatus was devised since the molybdenum springs of the balance were liable to oxidation in that medium. It consisted essentially of suitable gas supply with purifying and warming circuit for same—flasks containing driers, etc., and tubes with glass wool, together with a heating furnace for gas—an electric furnace containing the tube with the test-piece, thermo-couples, and measuring instruments for rate of gas flow, etc.

Composition of the Mg alloys was as follows:—

No. of alloy	Al per cent	Zn per cent	Mn per cent	Mg
ML-4	6.35	2.48	0.25	Remainder
ML-5	9.44	0.59	0.33	,,

Effect of the purity of the surface of test-pieces on oxidation was not specially studied. The first series of tests were with air, of which several were made at the different temperatures: 400-600° for Mg and Al, and at 390° for Zn. Results were tabulated and graphed showing weight increases in mg/cm². Means for the several tests in each case were: Mg, 0.0160 at 400° to 0.809 at 600°; Al, 0.0070 to 0.03, and Zn 0.05. In the case of Al and Zn means are not given in the table and have been only approximately determined by inspection.

For the Mg alloys temperature range was 400-460° and means for ML-4 (ML-5 in brackets) were 0.0166 (0.0376) to 0.1286 (0.3642); and were therefore much larger in the case of ML-5. The temperature range was 420-460° for these alloys in the N, CO_2 and SO_2 tests; and weight increases were about the same for N and CO_2 and somewhat less for SO_2. Differences between ML-4 and ML5 were not quite so marked. The other metals were not tested in these three gases.

General conclusions were that: oxidation curves of Al and Zn in atmospheric oxygen and of Mg alloys in N_2, CO_2 and SO_2 were of parabolic form; oxidation curves of Mg and its alloys in atmospheric oxygen, on the other hand, were linear; increase of Al content in the Mg alloys increased the rate of oxidation of these alloys in all the test gases. Some tests of mechanical properties as affected by oxidation showed that, with Mg alloys, these were improved by action of CO_2 and SO_2 owing to protective effect of carbonate and sulphate films, so that heat treatment of these alloys in these gases or in N_2 was necessary. Finally, heat treament of Mg alloys in a protective atmosphere excluded the possibility of ignition of processed (machined) components.

Oil Refining in Europe

The increase in output of refineries of member countries since the war is the most striking feature of the second report of the oil committee of the Organisation for European Economic Co-operation released this week. Before the war these refineries produced only 11,200,000 tons, but production at the present rate of development is expected to reach 59,200,000 tons in 1952-53, which would meet almost the whole of the inland consumption of member countries of 61 million tons.

Corrosion Protection by Cold Phosphating

Russians Claim to Have Improved Process

THE advantages of cold phosphating, *i.e.*, at about room temperature, have long been recognised, and many attempts—some embodied in patents—have been made to realise a satisfactory method. According to V. S. Lapatukin (*Zhur. Priklad Khim*—Journ. Applied Chem., 1951, *24* (4), 373-382) these attempts in Germany and U.S.A. have mostly failed; and he claims, as is the custom in Russia now, that a much better process has been developed in that country, at the Scientific Research Institute of the Polygraphic Industries. He indicates some of the disadvantages of hot phosphating, that is to say just below b.p. of the solution, and emphasises the importance, in view of the great practical interest in Russia, of better methods at room temperature.[1,2,3,4] A great deal of work to this end has been done at the Institute in recent years.

Incidentally he refers to some German results as claimed for example in German patent No. 741,937 in which the so-called cold Bonderising is described, but is of opinion that the process therein described is unsatisfactory.[6]. He considers that his own method[7] disclosed in Russ. pat. No. 72,714 (1948) is greatly superior.* But even this was far from ideal and further research was necessary.

It is pointed out in the first place that it is not possible to work at a lower temperature merely by increasing the concentration of free acid in the bath, as has been proposed,[8] since the concentration of hydrogen ions (*p*H) should not exceed the known limits at which the reaction occurs: $5Me(H_2PO_4)_2 \rightleftarrows 2MeHPO_4 + Me_3(PO_4)_2 + H_3PO_4$ Eberty, Gross and Crowell in the U.S.A.[5], in working with the system $ZnO.P_2O_5.H_2O$ at 25-37°C. and at 98°C., have shown that at concentrations of P_2O_5 generally used in phosphating (up to 200 g./lit.) the precipitate formed in both cases consists of tri-substituted zinc phosphate exclusively. Acidity constant (K) calculated by these authors showed marked differences according to temperature: 0.71 at 98° and 0.013 at 25°. From this it was further calculated that at 98° one mol. of zinc dihydrogen phosphate was in equilibrium with 0.918 mol. phosphoric acid; but at 25° only with 0.338 mol. of latter; from which the respective amounts of free acid required in the two cases to form a phosphate coating can be readily found. Although the significance of acidity was thus established in regard to cold working Lapatukin thinks the permissible limits of hydrogen ion concentration for practical phosphating at room temperature must be determined; in conjunction too with other factors: nature of phosphate cations, nature of accelerating agent and its concentration etc. As Schuster and Krause had shown[6] there are definite relations between these factors.

Low Temperature Phosphating

In any case it had been found that zinc dihydrogen phosphate is among the most suitable salts for low temperature phosphating. With concentration of 24 g./lit. P_2O_5 the *p*H, bearing in mind the other factors, should be 2.7 to 3. With higher concentrations of P_2O_5 it is less. In lowering the temperature from 98 to 20° the change in *p*H towards neutral in relation to the nature of the phosphate ions is in ascending series: Cd .. 1.9 Addition of oxidising a.gents Ca .. 1.0, Zn .. 1.2, Fe .. 1.2, Mn .. 1.4, or accelerators causes further change in *p*H which may reach 2.8. Optimum results with cold Bonderising were obtained with solutions of zinc dihydrogen phosphate of 60 point strength and addition of 12 g./lit. of chlorate (ClO_3) together with zinc ion content up to 22 g./lit.

A solution was prepared as above for use at room temperature in 'cold Bonderising', with total acidity of 57 points, or *p*H 2.2. The testpieces for phosphating were of tool steel (mark U-10) 60 × 70 mm., first ground and then degreased with soda ash solution; or given more elaborate treatment as follows: washed in flowing water, degreased in solution containing caustic potash, soda ash, and trisodium phosphate, washed in hot water, immersed in solution of sulphuric acid, common salt, again washed in cold water, in alkaline solution containing soda ash, and finally in cold water, then phosphated in a glass vessel of 1 litre capacity.

* Only a short abridgment of this specification is available in the Patent Office, and the sole distinguishing feature claimed is the addition of NaF to the solution. However, further details are given here in the text.

To avoid ageing of solution no more than 10 specimens were treated per bath.

Corrosion resistance of coatings was determined by the accelerated method or drop test of Akimov and Ulyanov[1] and colour by the Pulfrich photometer. Coatings obtained by this 'cold Bonderising' proved unsatisfactory by the drop test (10-15 sec.), though phosphating was continued for more than an hour. Hydrogen evolution ceased in 5-8 min., but coating continued for the full hour—as could be noted from change in colour. It may be that in the early stages insufficient attention was given to *p*H, but though this was to some extent rectified afterwards by additions to the bath of zinc or calcium oxide, or otherwise to bring the *p*H to 2.6-2.8, results were little or no better.

It was evident that the cold Bonderising solution was less active than the hot, and some means must be sought to increase its activity. After much experiment it was found that fluorine and especially sodium fluoride was a useful agent for this purpose. Addition, for example, of 6 g./lit. NaF to above solution had a marked effect applied to steel U-10, *p*H was 2.8 to 3, time 40-50 min., and a well-bonded micro-crystalline coating was obtained with improved corrosion-resistance. Presumably the temperature was about 20°C. In later tests, instead of zinc dihydrogen phosphate, a special ferro-manganese preparation from one of the Moscow factories was used, known as Mazhef, with zinc nitrate as accelerator in ratio of $P_2O_5 : NO_3 = 1 : 1$. Pointage was 78. Effect of NaF concentration on *p*H, corrosion resistance of coating, and its colour was studied. *See* Table 1 below. Here total acidity was 78 (K), nitrate of zinc addition was 92 g./lit., and phosphating salt Mazhef:—(In test without NaF acidity was 60).

TABLE 1

NaF g.lit.	Temp. °C.	*p*H	Time min.	Corrosion resistance, min	Colour (% white)	Remarks
–	19	3.0	60	nil	—	Useless
1	19	3.1	55	1.5	15	Coatings
2	19	3.2	50	2.0	18.5	small
3	19	3.4	30	2.5	19	cryst.
4	19	3.8	50	1.0	19.5	bright,
6	19	4.3	50	0.5	20	stable
10	19	—	50	0.25	22	Mean increase in weight 9 g/m²

Coatings obtained with solutions containing only Mazhef and NaF were coarse-grained, thick, very slowly formed, with little anti-corrosion efficiency. Supplementary constituents are therefore essential, *e.g.* accelerators in the form of one or more oxidising agents together with substances lowering free acidity, such as oxides of zinc or calcium. Strongly alkaline additions are not recommended.

It was found that optimum conditions should include precise attention to free and total acidity $\eta = \frac{K\ \omega t}{K\ \text{free}}$ which should be within 12 to 15, as compared with 7-8 in hot phosphating.[3,9] Photo-micrographs show that coatings by cold phosphating are of finer grained structure and more uniform, with greater covering power and better bonding with base metal. Yet the author adds, in respect to corrosion resistance, they are somewhat inferior to coatings by the usual or hot method.

In regard to the time factor, this so far has been rather excessive and practically ignored, for it was thought best that sufficient time should be allowed to complete the phosphating process. Of course, in the literature it is recommended that shorter periods should be used in cold working, not exceeding 10 min.,[6,12] and much shorter times than this have been claimed for the hot method. In the cold process the usual method of establishing the end-point, namely cessation of hydrogen forming, is not valid; for it ceases after 3-5 min., while phosphating goes on for long afterwards. A more reliable guide is increase in weight. This in g.m.² increased from 7.3 in 10 min. to 9.2 in 50 min., while corrosion resistance also increased from 0.25 to 2.5 min. (Temperature 19° and *p*H 3.4). These figures were very nearly attained in 30 min. (8.9 and 2-2.5); so that 30 min. may be said to be the minimum.

Considering now more closely the effect of temperature, experiments in raising this above room temperature showed an optimum point at about 25-6°. The author here refers to electro-phosphating at temperatures between 65-70° with a.c., quoting one or two of the numerous literature references and patents.[10,11] These are too well known to need further details here. The present Russian work included a repeat of these electrical methods at or about room temperature (20°) and under following

[*continued on page 300*

Zirconium and Zirconium Compounds

AMONG the latest chemicals to be manufactured in the United Kingdom are zirconium salts, which are being produced on a small scale by F. W. Berk & Co., Ltd. In the United States considerable interest is being taken in the development of these new industrial materials, but so far comparatively little work has been done in this country to explore the possibilities which exist. Large-scale production cannot, therefore, be expected until the potential markets have been sufficiently established.

The raw material from which zirconium salts are manufactured is zirconium silicate, commonly known as zircon, which is obtained in the form of a beach sand in association with other minerals. Britain's entire requirements of zirconium concentrates come from a 50-mile stretch of Australian beach between Byron Bay, New South Wales, and Southport, Queensland, and from Travencore, India. The zircon is separated from the associated minerals and shipped to Britain as a fine sand about 99.5 per cent pure. The average chemical analysis of the material shipped is zirconium oxide 66.9 per cent, silicon 32.6 per cent, titanium oxide 0.12 per cent and iron oxide 0.04 per cent.

In its natural form zircon finds a number of applications in the foundry industry, as an ingredient of frits for vitreous enamels, and in the production of special refractories. A minor outlet is in the manufacture of electrical heating appliances, where it is used as an insulating medium.

Mesh Specification

Mesh specification is important, as are physical and chemical properties, purity and quality being paramount considerations to most users. In general, both titanium and iron contents must be low and for certain applications a very pure grade is required. About 90 per cent of the material as shipped passes through 100 mesh. Except in the case of refractories, the finer the product the larger the number of applications it appears to find. To meet the requirements of many users the natural sand is therefore processed to produce zircon flour, which is simply the silicate ground to −200 mesh. There is also a wide demand for a purified and still more finely ground grade of flour which, among many other applications, is used in cosmetics as a replacement for zinc oxide.

Zircon's special properties render it suitable for a wide range of purposes where high refractoriness, chemical inertness, or high dielectric resistance are desired. It melts at 2,193°C., while the softening point is between 1,600°C. and 1,800°C. No shrinkage takes place when it is heated to 1,750°C. Satisfactory resistance to abrasion is coupled with striking resistance to certain molten metals, acidic chemicals, slags and glasses. Thermal expansion is low and resistence to thermal shock very high. Thermal conductivity is medium to high, electrical conductivity very poor, and magnetic susceptibility extremely low. Zircon combines readily with sulphur and nitrogen, rendering these impurities harmless to steel.

Advantage over Silica Sand

Both in granular and flour form zircon is being used in the foundry industry to an increasing extent, an outstanding advantage over silica sand or flour being that free silica is present in infinitesimal quantities. Zirconium preparations are not, therefore, liable to give rise to silicosis and are approved materials under the Factories Act.

Zircon flour is the basis of a mould paint or wash, which gives remarkable results in the stripping and finishing of all types of castings requiring an exceptionally smooth finish. The comparatively rough surface of the mould face is covered with a coating of the paint which, by filling in the interstices of the sand grains imparts a smoothness to the mould, this being reflected in the corresponding smoothness of the finished casting. Similarly, the application of a zircon paint enables the cores to leave the castings more freely and imparts a high degree of smoothness to the inside of castings. The light colour of moulds and cores painted with zircon flour paint is an advantage in setting cores. In conjunction with Bentonite, zircon is used as a refractory facing sand for steel castings, which will strip almost free from this sand even in angles where cleaning is difficult.

Zirconium is of great value as an acid refractory material for use in the manufacture of firebricks, crucibles, muffles and other shapes where exceptionally high temperatures are encountered, and also as the

basis of a refractory cement or paint for the protective coating of other refractories.

In the United States, where the manufacture of special refractory shapes is more advanced than in Great Britain, zircon has been found unequalled as a refractory for use in the construction of the working hearth in reverberatory or open-hearth furnaces employed for the melting, re-melting or alloying of aluminium. Most other refractories fail due to penetration by metal, oxide or vapour, or thermit reaction with iron oxide and silica, or mechanical abuse when cleaning the furnace. Aluminium does not penetrate zirconium refractories, so that hearths built of this material are easier to maintain and production of cleaner metals is also facilitated. Zircon refractories have the peculiar property of being readily 'wet' by aluminium metal, dross or oxide. Since the apparent specific gravity is 4.46, the spalls or small particles of zirconium brick will not float in aluminium or its alloys. As refractories both zirconium silicate and zirconia (zirconium oxide) are important in the production of jet engine nozzles.

Slip Casting Method

A British patent covers a method of making refractories containing a high percentage of zircon. The slurries have a graded ground zircon content ranging from 96 to over 99 per cent. The slips, owing to the very high density of the zircon, have a high gravity and tend to settle or segregate. Slip casting, which is the method employed, necessitates accurate calculation of the amount of water and defloculating agents required to produce pourable slurries, since it is important to prevent any flocculation of the slurry before pouring or after it has been poured. Defloculation of the zirconium slurry is obtained by adding small amounts of a water dispersable colloid and a water soluble alkali. To produce the refractory the slurry is made up, poured into plaster-of-paris moulds, dried, and fired at 1,600°C. or—if exceptional resistance to corrosive molten fluids is required—at from 1,800 to 1,900°C.

Formerly the biggest difficulty in using zircon for refractories was to find a suitable bonding medium. The best bonding materials are those that hold the grains in position during and after the final burning temperature and are definitely incorporated in the article. Three systems of bonding have been developed. The earliest method was originated in the United States. It involved melting the zircon in special furnaces and casting it like a metal in a solid block, so that no bonding material was required. The second method is to let the zircon act as its own bonding medium, this being achieved by firing the refractory for at least one hour at a temperature of 1,650°C. The most up-to-date method involves the use of silicone esters, the ester most commonly used for this purpose being ethyl silicate. If this chemical is added to a slurry composed of zircon it is hydrolised, and as soon as the water content has been exceeded gelling occurs. The use of this method allows great dimensional accuracy to be obtained, together with a high resistance to thermal shock.

As an opacifier zircon is used in vitreous enamel frits and also in glazes for all classes of ceramic ware, from cone 03 to high fired ware, being equally suitable for lead-bearing and lead-free glazes. Apart from its usefulness as an opacifier zircon imparts colour stability not only to pastel colours but also to darker shades.

Unusual Properties

Another important field of applications is in the production of electrical and chemical porcelains. Zircon seems to impart unusual properties to some types of porcelain bodies. Used in proportions up to 70 per cent by weight, it confers great mechanical strength on bodies maturing as high as Cone 16. Zircon's low and regular thermal expansion makes it an ideal material for ceramic bodies that must withstand rapid changes in temperature. Other important advantages are high dielectric strength at high temperatures and extreme resistance to most chemicals. Zircon produces an excellent porcelain for chemical use, and when used in the manufacture of chemical stoneware imparts strength and resistance to chemical action.

Ordinary porcelains have excessive losses when subjected to high frequency current. For ultra-high frequency applications, installations made of zirconium porcelain have been found superior to those made from steatite porcelain.

Apart from its own uses in granular or flour form, zirconium silicate is the basic material from which the metal, the oxide, and all zirconium compounds are produced.

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Deformation & Corrosion

Part II*—Aluminium, Zinc, Copper & Steel

SPECIMENS of aluminium were annealed in saltpetre (potassium nitrate) melt at 450°C. for 40 minutes, cooled in air, then etched in 5 per cent NaOH solution at 60°C. for one minute, and worked up in concentrated nitric acid. Products of corrosion were removed by five minutes' treatment in hot solution containing 35 ml. phosphoric acid and 20 g. chromic anhydride per litre. Corrosion tests were made in two solutions: 0.3 mol. HCl and 0.5 mol. NaCl.

In the first the metal corroded with evolution of gaseous hydrogen; and in the second, at cathodic areas of the surface, there was acidic depolarisation. Tests in this case (with NaCl) extended to 120 days. The results for the HCl tests shows that up to an increase in load equalling 25 per cent yield strength corrosion rate increases; but further increase in load is practically without effect. In the NaCl tests there was little or no change up to 70 per cent yield strength, but from that point up to 90 per cent, corrosion rate increased. It is possible that here we have a breakdown of the oxide film, and that corrosion is accompanied by hydrogen evolution. Increase in corrosion of aluminium through deformation has been noted by other observers with solutions of nitric, sulphuric, and hydrochloric acids, caustic soda, and chlorides of copper and sodium[11,14,15].

Rate Increased

Zinc.—Test-pieces of zinc were annealed at 150°C. for two hours, etched in 10 per cent nitric acid for 1-2 minutes. Electrolyte used was 0.0125 mol. solution of sulphuric acid, with a *p*H of 2.3. Products of corrosion were removed in a saturated solution of ammonium acetate. Results show that, despite rather scattered experimental data, there was a general tendency towards increased rate of corrosion, with increase in deformation load. This may be explained, as in the case of aluminium, by an increase in the area of anodic areas through deformation. The slightly plastic cathodic areas consisting chiefly of the FeZn[7] binary phase do not deform.

Copper.—The copper specimens were annealed for two hours at 750°C., cooled together with heating furnace, and etched in 10 per cent nitric acid for 5-8 minutes, until a bright surface was achieved. As corrosive media, two solutions were employed: 0.1 mol. ammonium persulphate and 0.005 mol. sulphuric acid (as is well known, copper does not displace hydrogen from acid solutions). In these media the corrosion of copper is limited to access or availability of oxygen to the cathodic areas. In the presence of an oxidising agent such as ammonium persulphate, corrosion proceeds even with mixed control. No doubt changes in area of anodic and cathodic areas in this case must play a part.

Solution Buffered

The solution was buffered with a mixture containing 0.01 mol. phosphoric acid and 0.0033 mol. acid sodium phosphate, and the *p*H was 2. The results show that, as found in earlier work[14], with increasing deformation the corrosion rate in copper is reduced. Since copper has a relatively high potential the presence therein of other metal inclusions will not act as cathodes, and evidently cathodic processes will occur in areas covered with oxide film. In the presence of excess oxidising agent and predominating cathodic control, breakdown of the oxide film through deformation leads to diminution of the cathodic areas and a corresponding reduction in the rate of corrosion. In a 0.005 mol. solution of sulphuric acid, the rate of corrosion is limited by access or availability of oxygen to the cathodic areas. Deformation does not affect the rate of corrosion of copper.

Steel.—Specimens of low carbon steel, mark 10-20, were annealed for two hours at 850°C. and afterwards cooled. On etching with sulphuric acid the scale was not completely removed, so the test-pieces were machined, degreased in standard triphosphate solution[7], and lightly etched again in 10 per cent sulphuric acid containing addition of 0.2 per cent stannous chloride. Corrosion tests were made in 1.5 mol. solution of sulphuric acid, and as may be seen from

* For Part I see issue of 4 August, pp. 153-155.

the graph with increasing deformation there is an enhanced rate of corrosion. In the section of the curve representing 70-90 per cent yield strength this is much more marked than with lower loads. In high carbon steels, in corrosion with evolution of hydrogen, there are in the cathodic areas predominantly hard grains of cementite which are deformable to only a slight extent. Deformation of the solid carbon solution leads to an increased effective anode area and an increased rate of corrosion.

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Cold Phosphating

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conditions: *p*H 3.2-3.4, spacing of electrodes 8.5 cm. a.c. at 12v, current density 0.1 to 1.0 amp./dm². C.d. of 0.3 amp./dm² proved to be best giving corrosion resistance of 1.5 min. Results are graphed showing respectively (a) weight increase with time, (b) corrosion resistance with time. The former reached its maximum of 22 g./m² in 60 min., the most rapid increase being between 20 and 45 min.; and corrosion resistance attained 4 min. also in about 60 min. of working. With a temperature of 25° this corrosion resistance reached 8 min. Although the graphs show practically linear increases up to 60 min. working time, it is stated in the text that 30 min. generally should be sufficient. In preparing the test-pieces for phosphating it is now recommended that sand-blasting is best.

In his concluding general notes on cold phosphating the author claims that his method does not affect the mechanical properties of the metal phosphated, contrary to what has sometimes been noted with the hot method.[34] Cold phosphating should be of special value in mass production—continuous conveyor system—and in dealing with large components and articles by spraying.

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Zirconium & Its Compounds

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A marked interest is being shown in the oxide (zirconia), which is used for refractories, ceramic glazes and vitreous enamels, and which also has a potential field of applications in the field of glass.

The range of salts at present available includes zirconium carbonate, zirconium sulphate, zirconium stearate, zirconyl acetate, zirconyl nitrate, potassium zirconium fluoride, sodium zirconium sulphate, etc. As previously indicated, these materials are still in their industrial infancy. One of the applications in which great interest is being shown, more especially in the United States, is the use of the sulphate as a replacement for chrome oxide in the leather tanning industry. The chief outlet for this material seems to be in the production of white kid suede. The plumping action characteristic of this tannage has been found particularly desirable in the lighter weight kid skins, which could not previously be used for suede.

Because of its water-repellant properties the acetate solution has been used for the waterproofing of textile materials. The nitrate is finding potential applications in the field of atomic research while there are a number of other possible uses for zirconium salts which show considerable promise, but are still in the experimental stage.

*Editor's note : In German Patent No. 741,937 the solutions contain small amounts of copper or other noble metal, with p*H *reduced by 0.5 to 1 unit.*

Publications & Announcements

A POCKET-SIZE table of Brinell Hardness Numbers, incorporating other tabular information of importance to the metallurgist has been published by Steel City Testing Machines, Inc., Detroit 4, Mich. One side sets forth the Standard Table of Brinell Hardness Numbers for a 3000 kilogram load in the range from 682 B.H.N. to 93.7 B.H.N. The approximate Rockwell C Scale conversion is also given in the range from 62-C to 21-C. The other side contains three tables reprinted from A.S.T.M. Tentative Standard E-10. One of these states the recommended Brinell load for various ranges of hardnesses. Another gives the minimum thickness of specimen which can be harness-tested using the Brinell method. Also included is the A.S.T.M. recommendation for determining the type of ball penetrator to be used with different hardnesses. A copy of this convenient and useful 2¼ by 3⅞ in. card is available on request.

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'AMERICAN refineries—Some first impressions' is the subject of an article by H. Kaye, process superintendent of the Manchester Oil Refinery, Ltd., in the current issue of its journal 'Oil' (Vol. 1, No. 11). During a five-week tour of the U.S.A. Mr. Kaye studied new refinery plant developments and places visited included New York, Chicago, Oklahoma, Pittsburg and Boston.

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ANOTHER new product by Richard Klinger Ltd., is a 3/16 in. high pressure piston valve, claimed to permit controlled flow to an extent hitherto unknown. Primarily designed for instrument work, this new valve is tested hydraulically to a pressure of 9,000 p.s.i., and is suitable for oil working pressures up to 5,000 p.s.i. and superheated steam pressures up to 2,000 p.s.i. Added life and strength is achieved by having the diameter of the spindle larger than that of the piston, so that the load exerted on the thread when operating the valve is very small. As with all other 'Klingerflow' valves, say the company, throttling has no adverse effect on the efficiency of the valve, as wire-drawing will be experienced only on the bottom of the piston, whereas the sides of the piston, which actually seal the valve, remain unaffected. Maintenance is straightforward, and when, after long service, wear takes place, resulting leakages can be corrected immediately by tightening the bonnet nut, thus compressing the two valve rings more closely around the piston.

* * *

MONSANTO Chemicals have brought out an ingenious chart based on the 'help yourself to knowledge' principle by means of which they inform all those wanting to know about their range of 'Aroclors'—a series of chlorinated diphenyls and polyphenyls ranging in form from mobile liquids to clear resins. Their excellent electrical properties, inertness, fire resistance and wide compatibility, say the company, make them extremely valuable materials for many industrial applications, and the information supplied on the circular revolving discs covers the whole field from colour to dielectric constant.

* * *

LIKE most Government publications, *Colonial Plant and Animal Products* is always several months behind schedule and the issue for October-December of last year has just been published (Vol. 1, No. 4—1950, HMSO, 5s. net). In this case, however, no one will complain too much for the work reported in it is not of pressing importance although of some interest. The main article is 'Production and Marketing of Colonial Hides and Skins', by D. J. L. Furlong, and is the paper which was read before the Manchester Group of the Leather Trades' Chemists at Manchester on 14 March, 1951.

Other papers deal with the suitability of certain Northern Rhodesian hardwoods for the manufacture of fibre board, Tanganyikan lavender, patchouli and crocodile oil and avocado oil from Kenya. A 12-page bibliography of the more important reports, articles, etc., dealing with agriculture and forestry published during June-September, 1950, is included.

* * *

THE twenty-four T2 ocean-going tankers operated by the Esso Transportation Co., Ltd., are to have their cargo pumps fitted with Flexibox Mechanical Seals. In addi-

tion, the 'Esso' 26,500-ton tankers, now under construction, are to be similarly equipped.

Flexibox, Ltd., of Manchester, started their engineering activities in 1938 with the design and marketing of a new type of seal for oil refinery process pumps. Since then, the range of seals manufactured by Flexibox, Ltd., has developed rapidly and now covers many different fields, apart from the petroleum-chemical industry.

'Esso' T2 tankers are fitted with centrifugal pumps which handle crude oil and salt water alternatively. The pumps are horizontally split with stuffing boxes at either side operating at 1,750 r.p.m. at temperatures up to 140°F. Delivery pressure of the pumps can be as high as 125 p.s.i.g.

The Flexibox Mechanical Seals which were selected for fitting into these pumps are known as the RC Type which provide for positive circulation of the product from the pump discharge past the stationary and rotary seal rings back to the pump suction. This feature prevents accumulation of sediments and ensures that the seal remains at a suitable operating temperature under all conditions.

* * *

A NEW edition of the Year Book of the British Standards Institution has just been published.

Well over half of its 400 pages are devoted to a list of the 1,700 British Standards current at 31 December, 1950, with a brief description of the subject-matter and scope of each one. A complete subject index simplifies reference. In addition, a supplement listing the British Standards issued between 1 January and 31 March, 1951, is included.

The year book also lists the current membership of the General Council, which guides the institution's general policy; of the four Divisional Councils (Building, Chemical, Engineering and Textile), which direct the standardisation work; and of the 56 industry standards committees, each representing a major British industry, and through which that work is delegated to some 2,000 technical committees and sub-committees, whose members bring specialist technical and commercial knowledge to bear upon every standardisation project dealt with.

Copies of the Year Book may be obtained from the British Standards Institution, price 7s. 6d. each, post paid.

KEEN interest has been shown in the technical information about chemical products marketed under trade names in Europe and America which is available at the DSIR Technical Information and Documents Unit, Lacon House, Theobalds Road, W.C.1.

The information is contained in 29 reels of microfilm and is a photographic facsimile of the I. G. Farben Central Laboratory Index. The index appears to have been compiled between the years 1933-1943, although a few additional notes are dated 1946, and it comprises more than 57,000 cards. The information is given in alphabetical order under trade names and includes the chemical name of each product or its analysis, and its constitution and application. In addition, information about patents and literature reference is given.

Most of the entries refer to dyestuffs, but the index also covers resins, plastics, detergents, wetting agents, waterproofing and emulsifying agents, textile assistants, rubber accelerators, cellulose esters, synthetic rubber, oil additives, tannins, insecticides, solvents, pharmaceutical products and other commodities.

The index can be inspected at TIDU (Chancery 4411) by appointment and no charge is made for inspection. Photo copies of entries may be ordered and purchased.

* * *

'FIFTY Years of British Standards' is an illuminating record of the British Standards movement—showing how it originated in 1901 as the Engineering Standards Committee, how it has developed and contributed increasingly to the national economy, and how the British model, in this as in many other fields, has been followed throughout the civilised world.

Special chapters deal with the influence of the standards movement in the two world wars, and with its spread to all the countries of the British Commonwealth; with the relationship between standardisation and research; and with some of the brilliant figures in industry, science and the arts who have helped to build the movement during its half-century of steady growth.

Though the subject is highly specialised, the book is written in an easy, readable style, and it throws a long-needed light upon a facet of British industrial genius about which too little is generally known.

Copies may be obtained from the BSI, price 10s. 6d. each, post paid.

The Chemist's Bookshelf

THE STRUCTURE OF PHYSICAL CHEMISTRY. By C. N. Hinshelwood. Oxford University Press. Geoffrey Cumberlege, London. Pp. 470. 35s.

The astonishing growth of physical chemistry in the last few decades has in no way been paralleled by an increase in the time spent by the average student in attempting to acquire a grasp of this difficult and diversified subject. The inevitable result has been a tendency to severe mental indigestion on the part of the student. In the welter of facts and theories into which he is suddenly plunged in the honours courses in our universities it is difficult for him to see the interrelation between the themes, varied but surprisingly limited in number, which run through the whole of physical chemistry and which can be used to unify the subject in a a most satisfying way. This new book by Sir Cyril Hinshelwood attacks the problem in an original fashion and the author is to be congratulated on a remarkably successful achievement. Although it seems certain that the book will be widely read by university students it cannot be regarded, in any ordinary sense, as a textbook. Benefit, indeed is only to be obtained from it if the reader has already a working knowledge of a good deal of physico-chemical fact and theory. Granted this essential background the reader is led stepwise through practically the whole gamut of physico-chemical doctrine in something under 500 pages. At each stage the interrelation between ideas is lucidly and succinctly explained and the content of theories, often appearing surprisingly bare, is skilfully appraised.

As must be expected there is a certain amount of mathematics but only as much as is absolutely necessary for the arguments which the author develops. There is no mathematics solely for the sake of mathematics and everywhere elaboration of detail has been sacrificed for clarity in presentation. Strangely enough, the inclusion of a good deal of mathematics makes the book no less readable, probably because each step in the argument is explained and elucidated in such masterly fashion. In the last and perhaps most interesting chapter (certainly the most speculative) the author reviews attempts to apply physico-chemical laws and principles to the world of biology and of living matter. None is better qualified than he to attempt such a review and his reflections on the subject will be read with interest by everyone. Altogether this book can be unreservedly recommended to those interested in the growth of the subject and in the interplay of ideas on which so much of our progress in science is directly based. —R.C.P.

THE CHEMISTRY OF NON-BENZENOID HYDROCARBONS. Second Edition. By B. T. Brooks. Reinhold Publishing Corporation, New York; Chapman & Hall, London. 1950. Pp. 615. 96s.

Why is it that a second edition of a book which was first published in 1922 and has certainly been out of date for at least twenty years, should appear to-day? What information do we expect to find in a book with this title which would not be found in such general encyclopaedias as Richters Organic Chemistry or such smaller specialised monographs as 'The Reactions of Pure Hydrocarbons' by G. Egloff, or 'The Chemical Constituents of Petroleum' by A. N. Sachanen. These are the first two questions that the librarian or the private purchaser with limited means will inevitably ask himself when considering the purchase of this book.

The two questions and answers are inextricably linked, for it is the author's lucid and concise style and his excellent method of presentation which make it worth while publishing a revised second edition that is practically a new book, containing information which, even if at the time of printing it is novel, will soon be included in fresh editions of its competitors. On the other hand B. T. Brooks is a petroleum chemist and has written with a strong bias toward

petroleum chemistry. It is to chemists working in this field that this book will mainly appeal. Thus the large amount of work which has been carried out upon *cyclo*-octatetraene is reviewed in less than five pages while the subject of azulenes is dismissed in less than four, most of the spaces being occupied by formulae. Other subjects a little removed from the petroleum beat, such as the newer preparative methods from acetylenes, the acetylenes themselves, and the large ring compounds, are dealt with in a very abbreviated fashion, but while he is on the petroleum beat Mr. Brooks is excellent.

The problem of classification is one that has weighed heavily with the author, and in his preface to the first edition he quoted from 'The Outline of History' by H. G. Wells a passage to the effect that there is a tendency to exaggerate the similarities and differences of entities in order to classify them more easily. In particular he objected to the juxtaposition of benzene and cyclohexane because this implied a similarity in properties of the two different types of compounds. Whatever the position in 1922 we can see this now only as a facet of a much larger problem, the problem of classifying and indexing chemical knowledge. It is simpler, whatever the theoretical implications, to classify compounds under their properties and structure, or their methods of preparation. Both methods are in use, and both methods have separations of closely linked material or ideas. It is interesting to find that Mr. Brooks, who wanted to separate cyclohexane from its contaminating precursor benzene, has yet found it necessary to abandon complete structural classification and group some materials under preparative headings in his second edition.

One small criticism, and that is that the print type is of low contrast and very tiring to read for prolonged periods.—J.R.M.

THE POLAROGRAPHIC METHOD OF ANALYSIS. by Otto H. Müller. Second edition. Chemical Education Publishing Company, Easton, Pa. Pp. XII—209. Price $3.50.

The words 'polarographic analysis' and a few similar expressions create misgivings in the minds of independent consultants in case a faithful and valuable client should request this kind of work. For such chemists this book will act as a soothing balm. Everywhere the author bears in mind those who like to see a fair return for money spent and decline to part with hundreds of pounds on apparatus which may prove redundant after a few experiments. For instance the author, an American states: 'The parts of this apparatus were purposely chosen on the basis of cheapness . . . At a relatively little higher cost more precise resistors and voltmeters can be substituted and the set-up made accurate enough for most analyses.' But this is not all. He actually has the temerity to state openly, which many of us knew, that manually operated apparatus are ultimately more trustworthy than expensive lay-outs taking automatic records. Indeed, he warns the lucky possessors of such mechanical apparatus of the necessity of frequent manual checks. At the same time he gives details of new highly mechanised recording instruments and explains their advantages over simple home-made apparatus.

Before dealing with the subject proper, the author gives a comprehensive and unbiassed survey of other electro-analytical methods. The book describes essential and complicated polarographic instruments, the theory of the method and its applications to qualitative and quantitative analysis and involved investigations. Although the author is an enthusiast, he takes a sane view of its possibilities. He does not think it will replace the chemist, he says: 'Most analyses that are feasible polarographically require a careful combination of electrochemical and general analytical procedure by a well-trained chemist.' Indeed, in various parts of the book there are warnings on the many possible pitfalls which may result in entirely false conclusions.

The author makes much use of curves to illustrate his statements and does not fling about indiscriminately expositions of higher mathematics which unfortunately cover many pages of similar books. It is a book for anybody who would like to understand the possibilities, limitations and delusions of the polarographic method and wishes to supplement his findings by novel methods with a reasonable outlay of money. Mr. Müller makes it clear that at present the polarographic method is a modest additional tool in the hands of an expert chemist.—S.P.S.

• OVERSEAS •

Canadian Cellulose Acetate

A 500-acre wheat field is being rapidly transformed into a $41,000,000 industrial plant in the eastern outskirts of Edmonton, Canada. Workmen, using the farmhouse on the land as their offices, are clearing top-soil and pouring in the foundation for the huge Canadian Chemical Corporation petroleum chemical and cellulose acetate plant. The plant, expected to be in full operation within 18 months, will use purified pulp shipped from the corporation's dissolving plant at Prince Rupert, B.C., to turn out chemicals for Canadian and United States industry. Most of its acetate production will go to United States textile mills.

Sulphur Project in S. Australia

An agreement to develop deposits of pyrites at Nairne, 34 miles east of Adelaide, has been announced by Mr. Playford, the South Australian Premier. The project would ensure adequate supplies of sulphuric acid for production of the State's requirements of superphosphate fertiliser. The Nairne deposits are estimated to be sufficient for 100 years. Output is expected to be 360,000 tons of ore a year, which would yield 36,000 tons of sulphur.

South African Cement Mills Hit

The Transvaal cement mills of South Africa, and their big complement of secondary industries, have been hard hit by the coal shortage. Several of the big cement plants on the Rand have been working at half pressure because of insufficient coal to fire their boilers, and they have found wood fuel a poor alternative. Secondary industries which require cement for the fabrication of their products are stated to be hopelessly behind in the execution of their orders, and cement figures, when released, are expected to show a big drop for the winter months.

Lignite Fuel in America

The Aluminium Company of America is to build the first aluminium plant in history to use lignite for fuel near Waco, Texas. The plant will have an annual production capacity of 75,900 tons, and will employ 1,000 workers on its completion in the autumn of 1952. Recent technological developments have made feasible the use of lignite in aluminium production. Lignite, the 'young' brownish soft coal, is found in the Waco region to a depth of several hundred feet. When all units of the new plant are completed, the company's total commercial capacity will be 500,000 tons a year, with its added aluminium capacity since the outbreak of the Korean war mounting to 200,000 tons annually.

Break Coal Seams

A new mining device that breaks up coal seams without the use of explosives, and so reduces coal gas explosion risk, has recently been developed by Du Pont de Nemours & Company. The device works by means of compressed gases produced by a chemical reaction in a steel tube. The reaction is started by electrical contacts and when enough gas pressure has been built up, the end of the tube breaks and the pressure forces the rocks apart.

South African Chemical Shortages

A considerable range of industries in South Africa are having anxious moments because of a growing shortage of essential industrial chemicals. Chemical manufacturers report that they have received inquiries from the Far East for chrome tanning salts, and from New Zealand for sodium bisulphite, from Norway for butyl and amyl acetate, and from Britain for hypersulphite of soda butyl and amyl acetate. Unfortunately South Africa, like the rest of us, faces a severe sulphur shortage, and textile factories are becoming unable to carry out bleaching operations because the type of hydrosulphite they need is not produced in the Union. The prices of many of the chemicals still obtainable in South Africa have risen steeply. Instead of being able to get lithopone from Britain at £64 a ton, local firms are paying up to £177 for the German product. Zinc oxide is now being quoted at £245 a ton, stearic acid at £202 per ton, and dynamite glycerine at £500 a ton. Linseed oil is now £192 a ton, red and white lead over £230 a ton, and caustic soda is available in small quantities from America at £85 per ton.

HOME

Powell Duffryn Limited

Powell Duffryn, Ltd., announce that as from 21 August the address of the registered office of the company will be: 19 Berkeley Street, London, W.1. Tel. No.: Grosvenor 3801. The previous registered office at 40 Lime Street, London, E.C.3, will in future be the City office of the company. The transfer office of the company will continue at 17 Overton Road, Sutton, Surrey.

Change of Telephone Number

As and from 1 September the telephone number of High Duty Alloys, Ltd., will be changed from Slough 21201 to Slough 23901. The address remains 89 Buckingham Avenue, Slough, Bucks., and the telegraphic address remains the same.

Gauge Manufacturers' Association

For some years past, several of the leading manufacturers of pressure gauges have been members of the BSI Committee drafting the first British Standard for Pressure Gauges, and during the discussions it became increasingly evident that the industry could reap considerable advantage if means were established to enable manufacturers to contact one another readily. With these thoughts in mind a meeting was recently held, when the British Pressure Gauge Manufacturers' Association was formed, and there is no doubt that this new association, by its exchange of views and information, will be to the advantage of the user as well as the manufacturer. The association will not in any way concern itself with the control or maintenance of prices, or any other restrictive practices. Messrs. Dixon, Hopkinson & Company, chartered accountants, of 15a Steelhouse Lane, Birmingham 4, Tel. Central 7711, to whom any correspondence should be addressed, have been appointed secretaries.

New Laboratory at Wall's

T. Wall & Sons, Ltd., the ice-cream manufacturers, have opened a new physical laboratory at their West London factory. The new laboratory will extend the facilities already provided by the existing analytical and chemical laboratory. Since the quality of ice cream depends to a great extent on its physical properties such considerations as texture, for instance, are factors of considerable importance in determining taste and enjoyment.

Research, aimed at improving texture, will, therefore, be one of the tasks of the physical laboratory, which will be in charge of Mr. M. G. John, B.A., B.Sc., assisted by Mr. I. Nicol, B.Sc., A.R.C.S. The laboratory will be under the general direction of Wall's chief chemist, Mr. George H. Searle.

Work of the new laboratory, in addition to studies of ice-cream texture, will include examination of the emulsification and stabilisation of liquid ice-cream mix. Microscopical studies of distribution and size of the fat globules, together with such factors as surface tension, will also be undertaken, and the laboratory will also control the viscosity of the mix to ensure that a constant product is turned out. Electrophoretic measurements will be employed in the study of emulsions.

Changes in Board

An announcement on behalf of the London Aluminium Company states that Mr. E. W. Wynn, Col. C. A. B. Lindon, and Mr. F. P. Webster have been appointed directors. Mr. Millership and Mr. Salvin have resigned their offices as directors and will devote their whole time to their duties as works managers.

Retail Soap Flake Prices

The Ministry of Food has announced that the Soap Order, 1950, has been further amended so as to increase the maximum retail price of soap flakes sold loose from 1s. 5d. to 1s. 6d. a lb. with effect from 26 August, 1951. This increase is necessary because of the general rise of soapmakers' costs, particularly of wages, transport and packing materials.

In addition the Ministry has agreed that manufacturers may submit for approval new retail prices for individual brands and packs of packeted soap flakes and soap powders. The amount of any increase approved will depend on individual circumstances but is likely to be about ½d. per 6 oz. Where increases are approved, they will take effect as and when stocks at the new prices reach the shops.

PERSONAL

Five chemists have been appointed by the U.S. Department of State to serve as scientific attachés in overseas posts. Two, DR. HANS T. CLARKE, professor of biochemistry, and DR. L. H. FAIRHOLT, associate professor of chemistry, both at Columbia University, will take up their posts in London. DR. W. L. DOYLE, professor of anatomy at the University of Chicago, and DR. R. L. LOFTNESS, a physical chemist from North American Aviation, Inc., will assume their responsibilities in Stockholm, and DR. L. LEK, recently of the Scripps Institute at La Jolla, will be posted to Berne. Dr. Clarke is an authority on the chemistry of biological compounds and has an understanding of international relations in science and other fields, having studied and taught at universities in Great Britain. Dr. Fairholt, his associate, has considerable industrial and laboratory experience, and specialises in organic synthesis.

Metropolitan-Vickers Electrical Co., Ltd., announces that DR. C. DANNATT, director and chief electrical engineer, is appointed director of research and education in place of SIR ARTHUR P. M. FLEMING, who will retain his seat on the board. Dr. Dannatt is also appointed assistant managing director. MR. H. WEST, assistant chief electrical engineer, is appointed chief electrical engineer (in succession to Dr. Dannatt) and is also appointed to the board of the company.

LIEUTENANT-GENERAL SIR FREDERICK MORGAN has been appointed Controller of Atomic Energy in succession to Lord Portal of Hungerford, it was announced this week by the Minister of Supply. General Morgan, who is 57, has had a distinguished military career. After holding a number of important commands during the first years of the war he was in 1943 appointed Chief of Staff to the Supreme Allied Commander (designate). He was head of the British and American planning staff for the invasion of Normandy in 1944 and later became Deputy Chief of Staff to General Eisenhower. After the war, the general was appointed Chief of Unrra operations in Germany, from which post he retired in 1946.

Obituary

By the death of DR. EDWIN M. H. WILDT, F.T.I., at his home in Leicester, on 21 August at the age of 69, the Textile Institute has lost one of its distinguished members. A vice-president of the Institute since 1940, Dr. Wildt was chairman of the Institute's Diplomas Committee, and a member of the Textile and Designs Committee. Last year, Dr. Wildt was awarded the Institute Medal for distinguished services to the textile industry in general, and to the Institute in particular.

Dr. Wildt was born at Bradford and secured a London University B.Sc. degree in 1904, and was awarded his Ph.D. at Bonn University in 1907. After a year's research work in the laboratories of Badische Anilin & Soda Fabrik, Ludwigschafen, he spent six years travelling the world as a Badische technical representative in the field of dyestuff application. In 1914, he joined the Leicester firm of hosiery and knitting machine manufacturers of Wildt & Co. Ltd., of which he was chairman and managing director until his retirement in 1946.

The death has taken place of MR. JOSHUA GRAINGER PRITCHARD, chairman and managing director of Pritchards, Ltd., manufacturing chemists, of Cheadle, Cheshire, at the age of 86.

The death occurred on 23 August of MR. HARRISON JAQUES, of Oakworth Manor, Oakworth, Keighley, at the age of 75. For many years an active figure in the industrial life of Bradford, he was best known as managing director of the Cravenette Co., Ltd., proofers, of Bowling Dyeworks, Bradford, which is linked with the Bradford Dyers' Association. He went to the B.D.A. in 1906 and in 1910 to the Cravenette Co., which at that time was a comparatively small concern. Its development and growth into an important undertaking was due in no small measure to the efficient control of Mr. Jaques, who retired from the position of managing director in 1939.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ALLEN & HANBURYS, LTD., London, E., manufacturing chemists, etc. (M., 1/9/51). 5 July debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; general charge but excluding premises specifically mortgaged by a Trust Deed dated 27 March, 1951, the charge hereby created ranking in priority to said Trust Deed to the extent of £350,000 at any one time. *55,284. 12 January, 1950.

New Registrations

M. Howell (Chemists), Ltd.

Private company. (498,683). Capital £2,000. Manufacturing chemists. Directors: Mrs. H. Howell and Mrs. M. Williams. Reg. office: 227 Park Road, Cwmparc, Glam.

Seaweed Agricultural, Ltd

Private company. (498,665). Capital £3,000. Manufacturers of, agents for and dealers in fertilisers, plant foods and soil rejuvenating products from seaweed for use in agricultural and horticultural industries; dealers in chemical and other manures, etc. Directors: F. Milton, W. A. Stephenson. Reg. office: Blankney Hall, Lincolnshire.

L. E. West and Co. Ltd.

Private company. (498,721). Capital £2,000. Manufacturing, research, dispensing and analytical wholesale and retail chemists and druggists, etc. Director: L. E. West. Reg. office: 21 Aldgate, E.C.3.

Increases of Capital

The following increases of capital have been announced:—BALDWIN CHEMICAL SALES, LTD., from £7,000 to £12,000; SAEZ & CO., LTD., from £5,000 to £10,000; B.B. CHEMICAL CO., LTD., from £55,000 to £275,000; BRITISH ORGANIC PRODUCTS, LTD., from £100 to £1,000.

Company News

Beecham Group, Ltd.

Trading profits of the Beecham Group for the year ended 31 March, 1951, amounted to £2,735,077 (£2,427,430)). Home sales reached a new record of £16,060,035, an increase of 10.5 per cent. An increase in price of many toilet products and some pharmaceuticals was necessary towards the end of the year. This was due to the rise in cost of nearly all raw materials, particularly glycerine. A final dividend of 4 per cent on deferred shares is recommended, making a total of 40 per cent (less tax) for the year.

The Distillers Company

In their report and accounts for the year ended 31 March, 1951, it is revealed that the total assets of The Distillers Co., Ltd., now total £93,198,901, compared with £77,709,624 a year ago. Stock accounts for £42,770,446 (£35,588,938) of the total and cash and bank balances for £10,322,940 (£5,644,794). Consolidated current assets aggregate £71,733,468 against £60,096,134. Assets of the parent company of £61,533,171 compare with £52,693,927, current assets being responsible for £12,303,763 (£13,690,676). Current liabilities, provisions and dividends of the parent company amount to £3,680,338 (£3,198,597), a deferred liability for the pension scheme figuring at £728,478 (nil). The meeting will be held at Edinburgh on 14 September at noon. Mr. Henry J. Ross is chairman.

Johnson Matthey and Co. Ltd.

Nearly £2 million is being raised by Johnson Matthey & Co., Ltd., by the issue of new ordinary shares, to holders of the existing ordinary shares and of the 3½ per cent unsecured loan stock registered at the close of business on 14 August. Issue price is 54s. per share payable as to 30s. on acceptance or application and 24s. on 4 December.

Murex, Ltd.

Formation of a special reserve in which will be placed the difference between the dividends permitted by statute (if the Government's proposals are carried through) and what would have been paid without interference is announced by the chairman of Murex, Ltd., Mr. George P. Joseph, in his survey of the year ended 30 April, 1951. The money thus set aside would be invested in short-term securities. The meeting will be held at the Great Eastern Hotel, London, on 19 September.

Sir John Cass College

Details of Autumn Lectures

DETAILS of a number of lecture series to be held at Sir John Cass College, Aldgate, for the session 1951-1952, are given below:—

Statistical Methods in Scientific and Industrial Research by A. J. Favell.

12 Lectures—Statistical Analysis. Beginning 24 September, 1951, 6.45 p.m.

12 Lectures—Design of Experiments. Beginning 7 January, 1952.

Spectrochemical Analysis by A. S. Nickelson.

12 Lectures. Beginning 28 September, 1951. 6 p.m.

Quantum Theory of Metals by Professor C. A. Coulson.

6 Lectures. Beginning 30 October, 1951. 6 p.m.

Crystal Physics by L. A. Thomas.

10 Lectures. Beginning 4 October, 1951. 6 p.m.

Fundamentals of Microbiology by T. H. Anderson.

30 Lectures. Beginning 2 October, 1951, 6 p.m.

General Technology of Petroleum by L. W. G. Firman, P. F. Ellis and E. J. Boorman.

22 Lectures. Beginning 4 October, 1951. 2.45 p.m.

Lubrication by C. B. Davies, A. W. W. Kirby, C. S. Windebank, O. T. Jones, D. Whyte and R. S. Teale.

6 Lectures. Beginning 1 November, 1951. 6.30 p.m.

The Theory of Lubrication; The Manufacture of Lubricants; The Testing of Lubricating Oils and Greases; The Lubrication of Internal Combustion Engines; The Lubrication of Steam Engines, Turbines and Compressors; The Lubrication of Gears and Bearings, and Special Lubricants Applications.

Industrial Law by Eric Walker.

12 Lectures. Beginning 27 September, 1951. 6 p.m.

The English Legal System; Contracts; Other Important Rights and Liabilities; Legal relation of Employer and Employee; The Factory Acts; Patents, Designs and Copyright; Trade Marks and Trade Name Protection.

CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

UNIVERSITY OF MANCHESTER
The next session commences on Thursday, 4th October, 1951.

SITUATIONS VACANT

GRADUATES required for research in the development of new processes on an existing Pilot Plant in an old established industry. Investigations will include furnacing operations, physical, inorganic and gas reaction problems, and analysis, with a view to developing analytical methods of plant control. The work will involve investigations on the plant itself as well as in the laboratory. Ample scope for originality and initiative. Good prospects. Previous experience not necessarily essential though some research experience would be of advantage. Permanent appointment. Applications stating age, experience, etc., should be made in writing and addressed to **Reckitts (Colours) Ltd., Morley Street, Hull.**

OIL Refinery Contractors handling large contracts for refinery plant require **CONTRACTS ENGINEERS** in their London office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience, including a wide knowledge of pumping, heat exchange equipment and instrumentation, and the appointments offer excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience to **Foster Wheeler, Ltd., 3 Ixworth Place, London, S.W.3.**

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